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REAR-ADMIRAL P. H. COLOMB, Member of Council, in the Chair.

CORROSION AND FOULING OF THE BOTTOMS OF IRON AND STEEL SHIPS, AND MEANS OF PREVENTING THE SAME.

By CHARLES F. HENWOOD, N.A.

THIS matter is of great national importance, both in relation to our ships-of-war and our vast mercantile marine, involving as it does at the present time the annual loss of hundreds of thousands of pounds sterling.

Ever since the introduction of iron, and more recently of steel, in the construction of ships, corrosion has been and is an element of weakness and danger, more particularly so in regard to steel-built vessels, in which the margin of thickness of the skin-plates is not so large as in iron.

It would appear from the early rules of Lloyd's Committee, the thickness of the plates for twelve years' iron ships was an eighth of an inch greater than for those of the six years' grade. The experience of the Committee, therefore, pointed to one-eighth of an inch as the waste due to six years' corrosion. And the following experiments made by Dr. Calvert and Mr. Johnson are interesting, although the conditions under which they were made differ materially from the conditions pertaining to the actual life of iron and steel ships, and are the results from oxidation of both sides of the plates.

Loss of Weight per Month per Square Foot of Surface.

	In a vessel of sea-water.	In the sea.
	lb.	lb.
Copper	0·0027	0·0061
Zinc.....	0·0012	0·0070
Iron.....	0·0056	0·0204
Steel	0·0060	0·0216

The effect of zinc in protecting iron or steel from oxidation has been known for many years past. When the two metals are in contact, an electric or galvanic relation is established between them, by which the iron or steel ceases to be susceptible of corrosion by dilute acids, saline solutions, or atmospheric humidity.

Here is a piece of bright iron, protected by zinc on either side, which has been immersed first in a strong solution of sulphuric acid, and for the last eight months in strong salt water; and you may observe the iron remains bright, without any appearance of rust; even the nut and screw-bolt making the connection between the two metals is also completely protected from corrosion.

Marine boilers are now protected on this principle, and with the most satisfactory results, as regards efficiency and economy.

In former times wooden ships have been sheathed with zinc, but more for the purpose of preserving them from seaworms than from fouling; for in spite of the experiments of Dr. Calvert and Mr. Johnson, it was found that in case of wooden ships, treenail-fastened, a hard oxide was soon formed on the zinc, to which barnacles and weeds adhered very firmly.

On the other hand, on wooden ships, copper-fastened, the zinc wasted away in patches, the copper being electro-negative to zinc. No existing compositions really meet the difficulty of fouling; nor is there much prospect of success in that direction, as neither smooth surface nor poisonous composition will keep off barnacles and other marine growths; and the only means of accomplishing this is by the oxidation and wasting away of the surface, which, in parting with a portion of itself, carries away with it such parasites.

Within the last few days, I have had placed in my hand a circular of a Mr. E. Wood, "Manufacturing Chemist and Contractor to H.M. Board of Admiralty," advertising his "Protective and Anti-fouling Compositions, &c., for the bottoms of iron, steel and wooden ships," and which, he states, is "An excellent preservative to *metal sheathing*, lessening wear and tear."

Mr. Wood remarks as follows in his circular:—"Constantly is a rumour heard of the coming perfect anti-fouling, until at last there is utter scepticism as to its possibility, and shipowners swear by the latest specimen that, by some accident, they have been persuaded to accept, and generally without inquiry into the matter at all commensurate with its importance. A bill for a few hundred pounds spent on the boilers or engines, in order to obtain a knot or two more of speed, is expected as a matter of course, and then the vessel is supplied with some composition on the bottom, which neutralizes the extra power in the engine-room.

"But the anti-fouling ought only to be considered as coincident with the protection of the plates, for if the iron is not thoroughly protected from the sea-water, or perchance of any composition that may be applied over the protective coatings, the very iron of the ship may suffer. The requirements of the protective coatings are then a 'thorough bite of the iron' and 'insolubility in water.'

"Compositions may, broadly speaking, be classified into two divisions—the *grease* and the *paint*.

"Greases, such as tallow, and others sold under different denominations, have been in general use, but with very moderate results. Their efficacy depends on the gradual falling away of the grease, and with it the various attachments. The greases labour under the great disadvantage of having to be applied in a warm state, and, in the opinion of many, of retarding the vessel.

"The Patent Office records show numerous attempts on these clinging followers of the deep, in the shape of doses of arsenic, mercury, &c.; but it is now generally thought that these substances, poisonous to human and other life when taken into the system, are not poisonous to the low order of sea-life, nor indeed do we know that they take the poison into their systems.

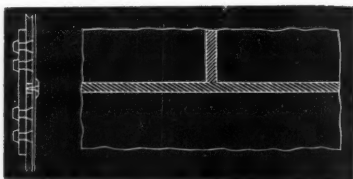
"It is better to pass over the wonderful nostrums recorded in some of these patents, in which nearly every article that can be made up into the shape of a composition is included, in the apparent hope that, amongst the variety of ingredients, something may act. In some instances, they have come like a comet on the scene, and, having served their purpose, have disappeared. And, indeed, it is easy to get a reputation for a good anti-fouling; given a steamer which sails for a month or two straight ahead, goes even into tropical waters, reposes in a clean or different water (such as a fresh water river, &c.), and with a quick return to the dry dock, we have the data for showing good results. Given also a voyage at certain seasons of the year, even in waters usually with a great tendency to fouling, and a clean bottom is the result. Given a voyage to certain ports that are blessed with cool and clean water, and we have the elements of success for any composition."

I may here quote the following, extracted from "A Manual of Naval Architecture," by the present Director of Naval Construction at the Admiralty, published in 1877. Mr. White writes:—"Various plans have been tried for attaching zinc sheathing to iron hulls; that more commonly used in the Royal Navy is as follows:—A single thickness of planks (3 to 4 inches) is bolted outside the skin plating; to this the zinc sheets are nailed; the strakes of planking are not caulked, but the water which finds its way under the sheathing can pass freely through the seams to the iron skin. Iron stems and stern-posts are employed; and by various means a certain amount of metallic connection is made between the zinc and the iron hull, such connection, as explained previously, being desirable in order to keep the surface of the zinc free from incrustation."

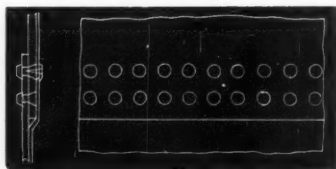
Now, it will readily be seen that by this plan there exists no *metallic* contact whatever; consequently no electric or galvanic action, or, if any, of the feeblest possible character. In addition to which there exists an insulating material between the iron hull and zinc sheathing, in the shape of the wooden planks.

Other plans have been proposed and patented, among which I may briefly describe those of Mr. Daft, Sir Nathaniel Barnaby, and Mr. McIntyre.

Mr. Daft's plan required that the ship should be specially built, or at least that the skin-plating of the vessel should be specially arranged; that is to say, the outside plating was to be worked flush with internal butt-straps at the seams as well as the ends of the plates. A space of about an inch in width was left around each plate, forming when rivetted up a groove into which compressed teak was to be placed. The zinc sheets were to be of about the same size as the iron plates, and nailed with zinc nails to the compressed teak in the grooves surrounding each plate; and where the plates were large, holes were to be drilled in the centre part, where required, and plugged with compressed teak or ebonite to receive zinc nails. Here the zinc sheets were to be laid directly on to the iron plating, without any insulating material between them; and so far a better plan than the above, yet the necessity for special construction, and its great expense, were reasonable objections to its adoption.

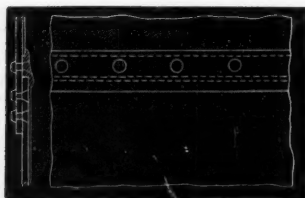


The plan of Sir Nathaniel Barnaby was more simple than that of Mr. Daft. He required no special construction or arrangement of the skin-plating, like Mr. Daft. He proposed to drill or form holes in the rivets, after the vessels were rivetted up, and fill such holes with a soft metal or other substance, and nail the zinc sheets with zinc nails into the soft metal or other substance. The simplicity of this plan of sheathing iron ships with zinc is apparent; but the risk attending the adoption of such a plan is also apparent.



Mr. McIntyre's plan consisted of rivetting galvanized iron strips, with grooves to receive the edges of the zinc sheathing, to the ships' plating, the middle portions of the zinc plates being secured by similar strips, or screws, into the iron plates.

I understand a vessel was actually sheathed on this plan of Mr. McIntyre, and proceeded to Australia, but when she arrived at Australia the whole of the zinc sheets had disappeared, not from



oxidation or wasting away, however, but from the insecurity of the method of fastening the zinc sheets to the iron hull.

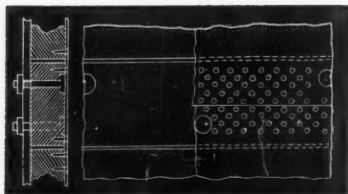
In each of these plans for sheathing iron ships with zinc sheathing, the main element of success is wanting; that is, contact between the two metals, the iron and the zinc, in order to establish complete galvanic action. The two metals, be it noted, must be in contact, not their respective oxides, which alone obtains in the plans I have referred to.

"Hitherto," Mr. White writes in 1877, "the practical difficulty has been to adjust the relative amounts of the surfaces of iron and zinc, contributing to galvanic action on the latter, in such a manner as to prevent too rapid or too local wearing of the zinc, without interfering with its anti-fouling properties."

I presume Mr. White had in his mind, when he wrote this, the plan "commonly used in the Royal Navy," in which, as I have pointed out, no metallic contact exists, and as a natural consequence galvanic action fails.

However, Mr. White further wrote (just ten years since):—"Before many years the question will probably be in a much more settled condition; and although there is little hope that zinc can ever be made to equal copper in its anti-fouling qualities and smoothness of surface, yet, if it be made fairly successful in this respect, it will greatly reduce the cost of construction, and the risks of accident or collision. Already it seems certain that a very great improvement upon the condition of unsheathed iron ships can be secured by the use of zinc sheathing. At present, therefore, the question of preventing foulness of bottom of iron ships stands as follows (1877):—By far the greater number of ships have their bottoms coated with some anti-fouling composition, and are docked for cleaning and re-coating once or twice a year, when it is practicable, and no serious loss of speed ensues. A few iron ships, designed for distant voyages, and in which the power of keeping the sea, without serious loss of speed during long periods, is of great importance, have copper or zinc sheathing. Copper can be made to answer well as regards anti-fouling, but it involves a large additional outlay, and is open to the charge of possible damage to the iron hull in case of accident."

The plan commonly used in the Royal Navy was adopted on an ironclad belonging to the Brazilian Government, and I am favoured by Sir Edward Reed, K.C.B., M.P., with the following account:—



"The sheathing of the ironclad you refer to was composed of East India teak, of good quality, $2\frac{1}{2}$ to 3 inches thick, excepting the keel, which was of English elm. The outer surface of the bottom plating was scraped and cleaned, and three coats of the best red lead were applied, and the inside surface and edges of the planks were covered with a thick coat of red lead. The planking was not caulked, and was secured to the iron plating of the vessel with $\frac{3}{4}$ -inch iron screw bolts, spaced about 2 feet apart, the holes in the bottom plating to receive these bolts were very carefully tapped, and the joints of the bolts were further secured by nuts, with a hemp grummet and washer on the inside. The bolts were made with a suitable slot in the head, and were hove up by a ratchet brace, observing that the heads were in all cases flush with the outer surface of the wood planks. The outer surface of the whole of the wood sheathing was covered with a thick coating of marine glue, and was further sheathed with Veille Montagne zinc, about $\frac{1}{16}$ th of an inch thick, secured with $1\frac{1}{4}$ -inch zinc nails.

"The wood and zinc sheathing extended from about $2\frac{1}{2}$ feet below the load water-line on the one side of the ship, to a similar height on the other, and at the upper edge the wood was snapped away, and the zinc sheathing brought over it and fastened to the armour plating by galvanized tap screws.

"The whole of this work was performed in June, 1875, and the vessel was in continuous service in South American waters, without being docked from that date to September, 1885, when she was placed in a dry dock in England. During this time I believe certain parts of the zinc sheathing were renewed by divers, but an examination of the state of the iron bottom in 1885 showed it to be in a remarkably good state of preservation, and requiring no attention whatever. The wood sheathing was also in a good state, and did not require renewal.

"The zinc sheathing had wasted away considerably, more especially in the region of the fastenings of the wood planking, showing conclusively that the galvanic action set up had acted as was originally intended, and that the plating of the ship was fully preserved."

Now we have seen that, to obtain proper galvanic action, the two metals must be in contact.

It will be apparent also, and experiments prove it, that zinc sheets of the same surface as the iron or steel will oxidize or waste away uniformly and evenly, and not locally or in patches.

It is found also, from experiments, that the waste or oxidation of the zinc sheathing, when in galvanic contact with iron or steel, is from the outer surface chiefly, and the oxidation or waste is from 2 to $2\frac{1}{2}$ ounces per square foot per annum; that of copper on wooden ships being about 3 ounces per square foot per annum.

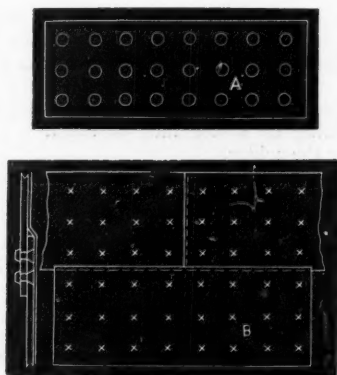
In the plan I have now the pleasure of submitting to you for preventing corrosion and fouling of iron and steel vessels, the two metals, the electro-negative iron or steel and the electro-positive zinc sheathing, are placed and permanently fixed in contact, by which means an electric or galvanic relation is established between them.

There is no insulating material placed between the hull and the zinc sheathing, which is fitted as closely as possible to the iron or steel hull.

No holes are drilled into the iron or steel hull, nor is any alteration of structure required.

The zinc sheathing is secured to the iron or steel hull by means of a zinc solder, which is less electro-positive to iron or steel than zinc itself, consequently will be more enduring.

The attachments are made at about 12 inches from centre to centre; and of such strength, that the sheathing may be torn off, leaving portions still attached to the solder, which also adheres firmly to the iron or steel.



The zinc sheets are 8 feet long and 3 feet wide. A template is made of the size of the sheet zinc, with holes about five-eighths of an inch in diameter, 12 inches from centre to centre, and 6 inches from the edges (Diagram A). The zinc sheet has similar holes punched in it, and around each hole a layer of zinc solder is fixed, about 1 inch in width; also along the upper edge and after end. The sheet is now ready to be attached to the side or bottom of the iron or steel ship. The template is then applied to the side of the ship where the sheathing is to be applied, and its position marked on the ship, and the position

of the holes (Diagram B). At the position of these holes the oxide of iron or steel is removed (with chisel and hammer or emery wheel) for an area of about $2\frac{1}{2}$ square inches, over which a layer of zinc solder is fixed. This part of the ship is thus prepared to receive the sheet zinc similarly prepared, and when put in place, the respective layers of zinc solder are united with a hot soldering-bit, at the same time the hole in the sheet zinc is filled up flush, and the attachment is complete. A practised hand can make about sixty attachments in an hour, and the largest vessel may thus be sheathed with zinc in about a week or ten days.

To test galvanically the endurance of such attachments an experiment was made by Professor Mosely, of the London University, who wrote as follows:—

"At your request I put on paper the result of an experiment made by us with a view of testing the power of resisting corrosion of a combination of zinc solder and iron prepared by you. You handed me a small square of iron plate about 3 inches in the side and one fifth of an inch in thickness, to either face of which were attached by means of their centres with solder similar but thinner plates of zinc. These plates of zinc were closely applied to the two surfaces of the iron.

"This combination of metals was placed by us in a large volume of a mixture of equal parts of commercial hydrochloric acid and water, which was allowed to act upon it for about a quarter of an hour.

"When the sample specimen was withdrawn, it was found that the iron had not been corroded at all, and that the solder on both sides of the plate had, as far as could be detected, not been acted upon at all by the acid.

"The zinc, on the other hand, was nearly removed, a thin, imperfect lamina only remaining on either face of the iron plate, still firmly held in position by the solder.

"I should infer that during prolonged exposure of a similar combination of metals in sea-water, all the zinc would be removed by corrosion before either the solder or iron would be attacked. It is important to note that the zinc has not, in the specimen referred to, been corroded most around the soldering point, but on the contrary, at its extremities."

This latter result is chiefly accounted for by the fact of the extremities not having had zinc protection.

With regard to the cost, I may mention that iron or steel ships may be sheathed with zinc sheathing on this plan at about one-tenth of the cost of the plan commonly used in the Royal Navy.

At the I.N.A., in 1864, Mr. Lampport observed, and the like observation may be made at the present time:—"Some gentlemen made light of the question of fouling. I took up the 'Shipping Gazette' the other day, and looked at all the ships overdue from China, the longest average voyage we have. They were all of them over six months on a voyage, which is from two to three months more than they ought to be."

A commander of the P. and O. Company observed:—"I have been in the habit of taking out several iron steamers before to distant

parts of the world, coated with different compositions, but invariably found that their bottoms were fouled with weeds and barnacles before we had been six weeks at sea, much retarding the latter part of the voyage, notwithstanding we had taken opportunities of scrubbing them off as far down as we could reach."

The late Admiral Fishbourne stated that when he was on the coast of Africa, an iron whaler came out from England; and though she had only left six months, and been cleaned as well as they could at sea with long brooms and ropes under her bottom every month, she had long grass and barnacles of immense size attached to her, in consequence of which she was not safe, as she would neither sail nor steer, and was not manageable.

The "Times" of 25th January, 1865, reported that:—"The 'Royal Oak's' bottom was found to be foul beyond all conception. Immense quantities of zoophytes, weeds, and coralline flourished in the wildest profusion, and so hard had the little insects formed their habitation, that nothing short of a general scraping with short scrapers would remove the incrustation, the result of barely six months' accumulation. Whether this rapid growth is due to the Muntz metal with which the ship's bottom is sheathed, or the result of some general galvanic action, is hard to conjecture." On the other hand, the armour-plating above the sheathing was found to be eaten away into holes and grooves half an inch to five-eighths in depth. Some of the plates contained no less than 188 of these, whilst none had less than forty. This corrosion appeared to have occurred wherever the paint had been worn off.

The "Times" of 3rd November, 1865, reported that:—"The condition of the 'Agincourt' at Devonport has created considerable surprise in the minds of the officers of the dockyard and others. About six weeks since she was removed from the Prince's Dock, after having been coated a second time with Hay's anti-fouling composition, and was placed alongside the sheer-hulk in Hamoaze, where she received her five iron masts, and was otherwise prepared for preliminary trial of her engines, which took place on the 12th ultimo. On Monday last the 'Agincourt' was replaced in Prince's Dock, and as the water was pumped out her bottom below the line of flotation looked, as one of the artisans described it, 'like a field of grass,' so regular was the growth of the weeds. Some were nearly 2 inches long, and it extended from stern to stem and down to the keel."

The French ironclad "Invincible" had not been docked for ten months, and when docked, the copper sheathing was found covered with a thick mass of marine vegetation, a sort of white coral, and many kinds of shell fish formed a stratum which completely hid the sheathing, and was 5 centimetres or nearly 2 inches thick over certain parts. There were also in certain places patches of oysters, which firmly adhered to the sheathing. There were not less than 10 tons of vegetable matter or fouling removed from the bottom.

Just before being docked and cleaned, she was tried under full steam, the weather being calm and water smooth, when her greatest speed was 9·8 knots with 51·5 revolutions. After being docked and

cleaned she was again tried, when her speed was 13·2 knots with 53 revolutions.

The "Shipping and Mercantile Gazette" of September 1st, 1865, records that the "Ceylon" and "Poonah" of the P. and O. Company were each coated with a new composition, and the result was "most extraordinary." Both ships have returned after their first voyage of a few weeks in sorry plight. The "Ceylon," notwithstanding she had been twice scrubbed abroad, in less than two months was found covered with grass from 12 to 18 inches long, and barnacles, zoophytes, &c., had begun to form all over the bottom, so that she was delayed on her homeward voyage several days. The "Poonah" was nearly as bad after only six weeks' absence.

And the following case is of recent, and I might almost say, of daily occurrence:—

A screw steam vessel, with a carrying capacity of 3,500 tons dead weight, started on a voyage from England to Cape Town, loaded; from thence she proceeded in ballast to Cocanada, and loaded for Liverpool *via* the Suez Canal. On the voyage out she indicated 947·06 horse-power, boiler pressure 76 lbs., speed 10 knots, and draught 23 feet on an even keel. On the voyage home she indicated 970·96 horse-power, boiler pressure 80 lbs., speed 7 knots, and draught mean 24 feet 2 inches (22 feet 9 inches forward and 25 feet 7 inches aft). As the small difference in her draught, taking also into consideration her trim, cannot be held accountable for a loss of three knots, there is nothing else but the state of her bottom to explain it. When placed in dry dock on arrival in England she looked exactly like a half-tide rock, and four railway-truck loads of barnacles and other zoophytes were removed from the dock. When cleaned she again made 10 knots speed, with 76 lbs. pressure, and 947·06 indicated horse-power.

The extra resistance of the fouling matter is plainly shown by the greater pressure on the boilers and greater horse-power.

The value of such a steamer may be reasonably taken at about 54*l*. per day. The loss of time due to fouling is eighteen days, thus making the total less on a voyage of four months 972*l*., without making allowance for the extra coals burnt.

To obtain 7 knots with a clean bottom would not require more than about half the amount of coal to obtain 10 knots; and taking the full consumption at 24 tons a-day there was a further loss of, say, 12 tons for 18 days, 216 tons at, say 30 shillings a ton, amounting to 324*l*., making a total loss of about 1,296*l*.

If such be the loss on one steamer during a four months' voyage, the loss on the numerous long voyage steamers and sailing ships must amount to an enormous sum every year.

"When one thinks" (remarks Admiral Paris) "of the number of steamers on the seas, of the thousands of tons of coal they burn, one cannot help seeing that the wealth of the whole country is being spent in this obstacle; the overcoming of which would produce enormous profits."

In conclusion, the position of the matter at present is as follows:—

Zinc as a sheathing, even as hitherto imperfectly applied, preserves iron or steel from corrosion in sea-water; and in certain cases from fouling.

It may, then, be fairly and reasonably assumed that zinc sheathing if applied so that the electro-positive zinc is in contact with the electro-negative iron or steel, an electric or galvanic relation being thus established between them, the zinc would be perpetually dissolving away in an oxide, and carry with it the barnacles and other zoophytes, leaving a clean surface; and thus iron or steel ships, so sheathed with zinc, may navigate the seas practically as free from fouling as our old copper-sheathed wooden ships.

The CHAIRMAN: This is a much more important subject than it generally looks, and I am sure we shall be very glad to hear anybody who can speak with some knowledge or authority upon it.

Mr. MARTELL (Lloyd's): I did not purpose making any remarks on this paper. I came here to hear what Mr. Henwood had to say, because I think there is a good deal of credit due to him for giving his attention to this question, which is one of very great importance to the mercantile marine. The principal reason why I now wish to speak is in reference to a statement made by Mr. Henwood, which I think, without some explanation, would be rather misleading. Mr. Henwood states that, judging from the rules of Lloyd's Committee, they consider that there would be something like a deterioration of one-eighth of an inch in iron plates, or waste by corrosion, in six years; that would be very misleading to go out to the public. The reason why Lloyd's rules made differences in their scantlings for different classes of ships was in order to enable shipowners to build ships of certain scantlings that would suit the particular requirements of their trade. A ship that was intended for over-sea voyage, or for North Atlantic voyages with the roughest kinds of cargoes, evidently would require greater scantlings than a ship engaged in coasting voyages, or shorter voyages, or carrying lighter goods, and consequently it was necessary to lay down different scales of scantlings, to meet certain particular trades that owners wished to build ships for, and still enable them to obtain a class in Lloyd's Register Book. The number of years assigned to those was more for the purpose of requiring that at the end of that time those ships should have a thorough examination; that all parts should be exposed in the inside, so as to be perfectly certain as to the amount of deterioration that had gone on; but to imply from that that Lloyd's Register Committee supposed that a vessel built of iron would deteriorate one-eighth of an inch in six years would be perfectly misleading. The rules were not framed at all on such an assumption as that. With reference to this general question of coating iron ships with zinc, of course, as Mr. Henwood has pointed out, various modes have been adopted in order to accomplish this, and if something of the kind could be done by which the bottoms of iron ships might be protected from deterioration and fouling to a greater extent than they are at the present time, a most important desideratum would be accomplished. Practical men and chemists of the greatest experience have devoted their attention to this, and I regret very much to say that up to the present time we have not accomplished so much as is necessary, and as we hope we shall be able to look forward to. But with reference to Mr. Henwood's particular plan, I think it is to be regretted that in this paper he has not called our attention to a vessel where his plan has been specifically applied, and where I believe, if I am not incorrect, it was done under the special supervision of Mr. Henwood himself. I allude to the yacht "Bessie," which I remember distinctly was so dealt with something like five or six years ago in the Clyde. Now in these remarks I am making, I trust Mr. Henwood will not think I am unduly criticizing his plans, but I merely wish to bring before the audience and the public, if it will come before the public, in any way, that here has been the actual practical application of this plan that has been brought forward here, to a sea-going vessel, and that consequently we have some very great and specific experience with reference to this, and I think this experience ought to be placed before us, in order to

enable us to judge as to the practicability of applying this plan, and likewise as to the efficiency of it after its application. It would be very interesting if Mr. Henwood would tell us what experience has likewise been gained since that time in other vessels; whether it has been applied to any other vessel, and if so, whether any better means have been adopted for securing this zinc on to the bottom; whether he has more specific data to bring before us as to the efficacy of this plan. In the yacht "Bessie," where this plan was applied with the full cognizance and under the supervision of Mr. Henwood himself, quite in accordance with the plan pointed out here, not a mere experimental plan in any way, but done in accordance with what Mr. Henwood professes to be his particular plan—after she had been running something like twelve months she was docked, and a large portion of this sheathing was found to be lost. A portion of it at the fore-part had been torn away, and the water had got between the surface of the zinc and the iron, and had burst through at the upper part in many places, forcing off the zinc at those parts. That only applies to the practical manner of attaching the zinc. I think it is very likely that that might be overcome, and therefore I would not condemn such a plan as this merely because some difficulty was found in keeping it perfectly secured to the bottom of a vessel. But there was something of far greater importance, and that was the actual principle of this application as to the effect which was claimed, and the initial purpose for which it was introduced, that is, the non-fouling of the bottom. Now the owner of this vessel found that, notwithstanding that this zinc was attached in this manner to the bottom of this vessel continuously, not as Mr. Henwood says the Admiralty may do it, here and there, or in contact with the bottom at certain parts, but in actual contact throughout with the iron plate of the vessel. Notwithstanding that, this zinc was continually fouling, not occasionally, but continually; and they were brushing it over continually, in order to get a clean bottom. When that vessel was put in dry dock, it was found that the grass had grown on the bottom of that zinc to the extent of 3 feet in length. Now that is a very important thing for Mr. Henwood to explain to us. He says, that in two metals coming in contact in this way, the galvanic action is found to take place externally upon the surface of the iron, and that consequently you would expect, and would have in fact, exfoliation taking place on the external surface of the zinc, and that therefore any adhesive substance which might be on that would naturally drop away. But that was not found to be the case when it was actually tried on the vessel referred to. It has occurred to me that it is possible that when two metals are brought together, zinc and iron, in this way, that where galvanic action takes place, it would be more likely to take place on the inner surface of the zinc, instead of on the outer surface, because a large surface like a vessel's bottom, where the vessel was passing through the seas, would be very differently affected from two metals put in contact with each other in a battery where you had a small quantity of water, and the water might be thoroughly saturated, so that the whole surface of the zinc might be affected on both sides. I am somewhat borne out in this by the actual result of the survey made by one of our surveyors, and which may be taken to be perfectly reliable, in which he found that on the internal surface there was a very thick oxide of zinc and salt, showing that there had been considerable galvanic action going on between these two internal surfaces, but it was very evident from the fact of those grasses 3 feet in length adhering to the external surface, that there could not have been any exfoliation, or else they could not have adhered as they did. I think it right to point this out, because it is a very important matter, and we have so many anti-fouling compositions at the present time that, as has been very properly said by Mr. Henwood, we scarcely know where we are with reference to a great number of them, and if anything could be applied that would have a thoroughly anti-fouling effect, and I appreciate it from your point of view as a naval Officer with regard to men-of-war, that it would be a matter of very great consideration, and I am sure, speaking for the mercantile marine, it is a matter that all shipowners are looking forward to, and that we professional men are looking to constantly. We hope the time will arrive when we shall obtain something which will be an effective protection against corrosion, and likewise against the foulings of the bottoms of iron and steel ships, but I fear that until we get either more experience or at least further explanation from Mr. Henwood, we cannot

accept, at least I feel that I cannot, his mere assertion that his plan would be effective for this purpose.

The CHAIRMAN: I ought to point out that in the discussion we may go by the title of the paper rather than the substance of it, because we have really come here to discuss the whole question of corrosion. If the paper had had another title we might have been tied to the particular plan before us, but if gentlemen who speak will refer to the general question, I think it will be better carrying out the object which the Council had in view.

Mr. MARTELL: If that is a sort of censure on the remarks that I have made or the view that I have taken, I feel, Sir, I must join issue with you on that point. This paper is as to the means of preventing the corrosion of the bottoms of iron and steel ships, and here it is specifically pointed out that there is *one* particular plan by which this might be effected, and I have dealt with that particular plan.

The CHAIRMAN: I think you were perfectly right. What crossed my mind was that you were restraining yourself to the particular points of the paper, which I do not think, owing to the title, it would be necessary for other speakers to do, but you were perfectly in order as far as you went.

Admiral BOYS: I wish to say just a few words, as a practical naval Officer, bearing on the general question of the fouling of iron ships' bottoms, my object being to give my experience as to the necessity and immense importance of keeping vessels under water as clean as possible. On taking command of the "Warrior," for her second commission, in 1867, I had a correspondence with her previous Captain, Captain Cochrane, a man well known in the scientific and naval world, respecting her qualities, and he told me that he considered the loss of speed of the "Warrior," when going at what in those days was thought to be high speed, viz., from 10 to 12 knots, was approximately $1\frac{1}{2}$ knots after she had been six months out of dock. My experience of her was the same. Nearly every question connected with a ship is involved, fighting efficiency, economy, consumption of coal, speed, and deterioration of bottom. I mention this fact to point out the absolute necessity of more being done with this object, and possibly something in the direction which the lecturer has indicated would have the desired result.

Mr. LEE: I am here to represent Mr. Scrutton, but I did not intend to say anything upon the subject. I will not speak on the scientific question specially, but I have been connected with dry docks for many years, and have had opportunities of seeing the condition of the bottoms of ships, and judging of the extent of the deterioration that has taken place. I have known many vessels which have been going to India and back for many years, coated with the present existing compositions, and really as far as the deterioration and the wasting of plates is concerned it has seemed to be almost imperceptible. Take for instance Mr. John Corry's ships, they are a very good class of ships, well built, and have been coated with a variety of compositions. One of these ships, "Star of Greece," made a voyage to India and back within six months, being as short a time as that in which very many copper-bottomed ships would do that work. That may apply to ships going to Calcutta, but of course in some waters where ships are very liable to foul, the bottom would suffer very much more quickly. I do not know that I can say further than that, but my experience is that the deterioration in the iron is a very slow process if the plates are well protected inside, and I have known some ships that in twenty years have only wasted to an almost imperceptible extent.

Mr. LEWIS: We have all heard anti-fouling compositions called very hard names, and I am conscious that I myself have called them perhaps harder names than almost anyone; yet I confess it is rather startling when we are told of ships being covered with coralline and masses of weed after a voyage of six weeks' duration, and those statements being brought forward from isolated newspaper cuttings. I think if Mr. Henwood had taken the trouble to inspect ships of the Peninsular and Oriental, or any well-known line, when they come into dry dock after fairly long voyages, he would not have made the case quite so strong against present anti-fouling compositions. If he took any ships coated with one of the dozen best of these, I think he would find that the deterioration of the plates and also the fouling is not nearly as bad as he makes out, and that really these compositions have a very much longer life than he supposes. What I would specially point out to you now is that

we want to prolong the life of our compositions, and not to bring out any more compositions or any more schemes which will only serve to protect and keep clean for a short time. We have plenty of anti-fouling compositions in the market which will do their work in the most admirable manner, for spaces of time extending with some, we may safely say, up to nearly nine months, and the great point which must be aimed at in anti-fouling compositions and protectives now is to find schemes which will carry on that period to a later date, to protect a ship for fifteen months or two years, instead of as at present, nine months. The question has entirely left the short period phase, because you can absolutely and perfectly protect your ships, and also keep them clean for periods under nine months. Now if you look at the subject of sheathing ships with zinc there are several very important points which must be considered. In the first place, if Mr. Henwood will carefully examine the zincs in any form of battery he pleases, I think he will not be quite as sure about the wasting of the zinc taking place on the outside, and not on the side of the plate nearest the other metal, and as in the case which Mr. Martell has pointed out, there undoubtedly would be a large amount of wasting of zinc between the two metals. And secondly, if the zinc plating is to keep off all fouling from the bottom, the exterior surface of that zinc must exfoliate so rapidly, that is to say you must have so strong a galvanic current, that instead of its being a prolonged method of protecting a ship, the plates would be destroyed in four or five months. Mr. Henwood gives some figures as to the rate of wasting of zinc when in galvanic contact with other metals, and I hope that in his reply he will tell us how those figures were obtained. He says, "it is found also from experiments that the waste or oxidation of the zinc sheathing, when in contact with iron or steel, is from the outer surface chiefly, and the oxidation or waste is from 2 to 2½ ounces per square foot per annum; that of copper on wooden ships being about 3 ounces per square foot per annum." I should like to know the experiment by which those figures were determined, and under what conditions the zinc wasted 2½ ounces per square foot per annum, because you must remember that when you have a large surface of zinc in contact with a large surface of iron, as in the bottom of a ship, you would, in the presence of sea-water, have really a very strong galvanic current, and if that is strong enough to throw off the fouling from its outer surface by a process of solution of the zinc, then I imagine that that zinc would have a very short life indeed. There is another matter to be considered, and that is the expense. If you look at the relative amounts of waste in iron and zinc, you will find that for every fifty-six parts by weight of iron saved from oxidation, you have sixty-five parts of zinc oxidized, and I dare say there are practical gentlemen present who can tell us something about the relative costs of iron and zinc. And not only do we have this wasting of zinc at the same rate, say, that iron would waste, but we have it wasted at an enormously quicker pace, on account of the galvanic action we have set up by making perfect contact with the iron, and I think it is from these points that we must look at Mr. Henwood's proposition.

M. CARL AUGUST HARTMANN: I wish to ask if Mr. Henwood can give us any idea of the cost of placing his sheathing on iron ships. I will not discuss as to whether the method is practicable or not, but even if it is so, it seems to me that it would be a great additional expense in the building of ships; or in the case of old ships it would necessitate the same being placed in dry dock for a very long time, and, of course, would greatly add to the expense. If a ship is to be protected with zinc sheathing, I believe it can only at the best be a surface protection. I have seen many ships coated with zinc sheathing that have become very foul after a comparatively short period, and I can also corroborate what Mr. Lewis has said as to the surface of the zinc being very much impaired. It seems to me, therefore, that the zinc itself will have to be coated with some composition, and it strikes me that if we are to have both the zinc and the coating it will mean a very serious question of expense. I therefore think it would be well if he could give us some idea as to what approximately would be the cost of putting zinc sheathing on iron ships.

MR. C. F. T. YOUNG, C.E.: It seems to be imagined that it is necessary for a tremendous oxidizing power to be applied to the zinc in order to keep it clean. That is not so, for so long as the surface is soluble the motion of the ship through

the water will keep the surface clean. The action is thus mechanical—it is a sort of chemico-mechanical action exercised on the outside of the plate. One of the speakers has alluded to zinc sheathing being more foul, but he does not tell us whether the ship was a wooden one or an iron one, because I have seen a wooden ship sheathed with zinc as foul as any iron ship has ever been. It is a great mistake to think that copper keeps clean by being poisonous, it is simply because the surface oxidizes and keeps greasy, and the passage of the ship through the water clears the dirt off. In one case where the zinc sheathing on iron plate had been under water for twelve months, I found that it had oxidized very equally and fairly. There is no doubt that the rate of oxidation will be increased by galvanic contact with unprotected iron. I do not see myself any particular difficulty in the matter. The only thing is it wants to be practically tested. We all remember that when Sir Henry Bessemer first proposed to blow cold air into hot iron to make it hotter he was laughed at and called a fool, but I believe the error was in not understanding the principle of the thing. I consider Mr. Henwood's plan has solved the question of practical application.

Mr. HENWOOD: I will first reply to Mr. Martell's observations, and I may say I agree entirely with what he said, and perhaps I might, at the expense of lengthening my paper, have explained more fully about the thickness of plating and corrosion of iron ships. I quite agree with what he said, because I know from my own experience that iron ships may be practically called imperishable. There is a river steam-boat built forty-six years ago which was running the other day carrying passengers, and is still serviceable. It was not with that object I introduced the subject, it was merely as an indication of former ideas. Of course there was nothing stated in the early Register of Lloyd's as the ground of this difference, and it was really left to the imagination to surmise the reason. I know further experience shows that iron ships will last an indefinite period. Now I did not refer to the matter of the "Bessie," and I did not refer to it on this account, because it is not identical with that which I have now introduced to you. The "Bessie" was the first experiment I made to sheathe a small vessel with zinc sheathing directly on the iron.

The CHAIRMAN: How long was that ago?

Mr. HENWOOD: The spring of 1881. I could not possibly get the men to work this zinc solder. I tried them in the laboratory, but could not get them to do it with their usual appliances for soldering, and a friend of mine who was interested with me in the matter suggested that we should fasten it on with common solder. Rather than not have the trial, and not having made the experiments which I have since done, I assented to its being so done. Now common solder is not of the same character as zinc solder. It acts in the first place as an insulating material, so that there was no galvanic contact between the zinc sheathing and the iron plating. On the other hand, I discovered after some time, especially in this ship, that we could not make sound connections with common solder, and this will be easily understood, especially by Mr. Martell, who knows, as I doubt not, that common solder directly it gets to the melting point runs, so that when the heat was applied to the solder it mostly ran down, and we only got a very slight attachment round the holes of the zinc sheets, not more than in some cases one-sixteenth of an inch. All along the edge of the water-line, although it looked pretty fair, when it was taken off it was found that there was practically very little attachment, in fact, if the next day or the day after I had applied the wedge test as I have done to this specimen, I should have pulled the whole sheathing off, so feebly was it attached, and it was probably kept so long as it was in its position from not being exposed to rough seas. The "Bessie" was only employed about the mouth of the Clyde. The Captain wrote to me that during the first portion of the time, about six months, the zinc on the outside was always of a greasy nature, and that putting his hand on it under water it had more the feeling of a live fish than anything else. But there being no galvanic contact between the iron and the zinc, it can easily be understood how it was that after some nine or ten months she began to foul, and she did foul in the same way as ships that I have seen in the Government dock-yards. Ships with the zinc sheathing fastened on to the wood lining on coming back to England have been very foul indeed. I think this explanation will answer Mr. Martell by showing him that the attachments on the "Bessie" were very

different to these attachments. This zinc solder will not "run" like common solder, and you can make the attachments perfectly sound and strong everywhere like this specimen. There was another vessel similarly sheathed, but not with my sanction. The late Mr. William Denny saw the "Bessie" in course of being sheathed, and he liked the idea so much, he said he would have his vessel sheathed, but I found out by that time that it was useless trying to make sound and strong attachments with common solder. It was, however, done by my then partner without my knowledge or consent. The "Bessie" met with an accident about three months after she was sheathed with zinc. She was going at full speed, and ran at about 10 knots on to a rock; she knocked her stem away and bulged her iron plates. She came back, and after her iron bow was repaired, I re-sheathed the new plating as before. The iron hull was perfectly covered with an inside of zinc, and there was no trace of corrosion, but the zinc sheathing itself did not appear to have wasted away at all, and apparently not at all on the inside. It is the same in these laboratory experiments, and if you look at them you will see the inside of the zinc practically is not touched.

MR. MARTELL: Is that done in salt water?

MR. HENWOOD: No, in a strong solution of sulphuric acid, but the same occurred in the "Bessie." The effect on the zinc inside did not appear so great as on the outside. Of course during those few months the depreciation of the zinc was very small indeed, in fact it was inappreciable. The question of fouling is answered by the fact that there was no proper galvanic action between the two metals in the case of the "Bessie;" that shows, if there is no galvanic contact between the two metals, and consequently no galvanic action, the fouling will take place just the same as it does in the cases of vessels of the Royal Navy sheathed with zinc over the wood lining where the zinc fouls almost if not quite as readily as on a wooden ship.

THE CHAIRMAN: What experiments are there to show that if the galvanic action were perfect, there would not be fouling?

MR. HENWOOD: Only laboratory experiments. There were, however, some experiments, I think in reference to Mr. Daft's plan, made under the sanction of the Admiralty in Portsmouth Dockyard. I hoped Mr. Young would have told us about that. Also a sheet of zinc and iron were secured on Mr. Daft's plan, and put down at Shoeburyness, and were there I believe some twelve months, but being in a quiescent state, the zinc was covered with a slimy substance which, however, could easily be rubbed off by the hand, leaving a perfectly clean zinc beneath. If that sheet of zinc which was exposed at Shoeburyness had been on the bottom of a ship passing through the water, there would have been the friction of the water to have removed this accumulation, so that the zinc would, by that mechanical operation, have exhibited a clean surface, and it was from such experiments and others I obtained the data that the oxidation was at the rate of from 2 to 2½ ounces per square foot per annum.

MR. LEWIS: Is not the water at Shoeburyness brackish water?

MR. HENWOOD: I should think very salt water.

MR. LEWIS: I think a ship coated with zinc, the "Audacious," which was guard-ship at Hull for some little time under very much the same circumstances, almost as near the sea, and in this brackish water no fouling or oxidation took place whatever, and it was thought the whole question had been settled. She was again coated with zinc and sent to sea; and the zinc plates I believe were very much acted upon, and the portions left were very foul, showing that experiments in brackish water at the mouths of rivers are not to be relied on as giving anything like normal results.

MR. HENWOOD: This specimen at Shoeburyness was not perfectly clean; it was covered with some slight accumulation, and it was only when that was removed, which could easily be done by hand, that the clean zinc was exhibited beneath, so that it could not have been under similar conditions to those mentioned in the north. The only other question I think was, as to the cost and time it would take. The cost at present, without special appliances, is about 10s. per square yard, and the largest ship might be sheathed on this plan in from seven to ten days.¹

¹ About four months after the "Bessie" was sheathed, the Captain wrote me as

The CHAIRMAN: Gentlemen, I am sure we shall all accord a hearty vote of thanks to the lecturer for his interesting paper, but before asking you to do so it is usual for the Chairman to make one or two remarks, and I suppose that, as I was last year Chairman of an Admiralty Committee on this subject, I might be expected to say something. I wish the paper had been read last year, because I was then hot on the subject, very hot, and I could have said, I think, something that would have been useful. Now, with the number of other matters that have come before me since, I am not so clear as I was twelve months ago, but still there are one or two points which are very prominently before me. I ventured to interrupt Mr. Henwood in his reply to put that question to him, where were the data to show that if the galvanic action was strong, good, and complete, there would not be fouling? As far as we have got you have observed the data are not very strong. I am not aware myself of any accurate comparative experiments ever having been tried, where in the one case there was complete galvanic action, and in the other case, under precisely similar circumstances, there was not. It seems to me, before other experiments are tried, that point ought to be established. My experience of fouling from the very first days when I came to consider it was that where the galvanic action was ostensibly strongest, the fouling was greatest. In paddle-wheel steamers, with copper sheathing, which were the first ships I served in, the fouling was always greatest in the wake of the paddle-wheels, and I rather assumed from that that there may be some special attraction to marine growths in galvanic action, and that then when they once get a grip, that they stop the exfoliation altogether. In the "Audacious," where I served for more than three years, I thought some of the strongest language I have ever thought in my life. I hope I did not express it, but I thought it on this very question of the enormous quantity of fouling that went on with zinc sheathing. I never saw anything like it. I never knew any kind of bottom foul so rapidly or to such an extent as on that zinc sheathing of Her Majesty's ship "Audacious." Of course the answer is made by the lecturer, that if the galvanic action had been complete, fouling would not have taken place. But the only proof that you can adduce on that head would be, was the iron of the ship attacked? Because it is natural to suppose if the galvanic action was not complete it would have shown itself on the iron. Now the iron was like virgin iron when the zinc sheathing was taken off in places, not a sign of corrosion. The zinc plates were continually wearing away, and, therefore, exfoliation of some kind was going on. These are facts which have been before me, and seem to me to bear very much upon the question. But, I think, as far as anti-corrosion goes, the zinc sheathing, however applied, is a complete remedy. But then I do not think that at the present moment (I follow Mr. Lewis) the corrosion is so important a matter as the fouling. The fouling is before us constantly. It was the great trouble of our forefathers in the last century. I think almost the greatest trouble they had. The cry for clean ships, the difficulty of keeping up blockade owing to rapid fouling of ships before the invention of copper sheathing, fills the official letters up to the close of last century. Now the result of that was the blockading squadrons were continually weakened by ships being sent home to be "cleaned and tallowed," as the phrase went. And as we stand at present, so far as I know, we should have to conduct our blockading in precisely the same way. While the enemy inside his ports would always have clean ships, being close to their docks, we on the outside would have ships that were fouling very rapidly after a time, and would have to be sent home continually to be cleaned

follows:—"The zinc on 'Bessie' does not yet show any signs of corrosion or fouling, while the buoy to which she is moored, and which has only been thirty-four days in the water, has a growth of baby barnacles on it already, besides a glutty sort of weed at least a couple of inches long; but then the buoy is of wood, coated with red-lead. As far as appearances go at present, the zinc sheathing looks like a success; in fact, if it continues to act as it seems to do at present, the success is a certainty. It looks extremely well without the patchy blotched appearance of paint, besides giving a perfectly smooth surface, much smoother than any sort of paint or enamel that I have seen tried."

just as they were in the middle and end of the last century. That of course would seriously weaken every blockading squadron, and would necessitate our providing at this present moment a greater number of ships for blockading purposes than would be necessary were we certain that their bottoms would not foul. That shows what a very important subject this is from the Royal Naval point of view. I had a letter only the day before yesterday from the owner of the "Galatea," the yacht which raced last year for the American Cup, and he pointed out that this question of the method of coating the bottom had a great deal to do with the racing trouble; and if something could be found which was absolutely smooth and would not foul, they would be very much better off than they are at present. These are the two plans only for anti-fouling before us, the plan of exfoliation, which has been adverted to to-day, and the plan of poisoning. So little is known about the subject that it is, I believe, almost impossible to say as yet how much the poison has to do with it, or how much exfoliation exercises its function in cases where manufacturers believe in the one or the other. Mr. Lewis put the case precisely. We want to extend the time. As he said, any of the good compositions will last for several months, as much as nine months in cases. That means that the ship will be in a fair condition for nine months, but then it very much depends upon the water she is in, her motion through it, the season, and a number of things that we know very little about. These seem to affect the fouling, and sometimes under apparently precisely the same conditions, you get totally opposite results in the fouling. The sum of it to my mind is, that we should look to compositions more than to any system of sheathing, that at present we are more likely to get on a sound basis in that way; but the inquiry must be made scientifically. The facts are not known; nobody really knows very much about it either way. I was only sorry that the money ran so short that our Committee could not go on sitting, because we were attacking the subject in a way that had already given us results, and we were bound to have got more results, because with the aid of Mr. Lewis for chemical matters, and with the aid of the naturalists of the British Museum for the animal and vegetable growths, we were gradually coming to see certain laws that were evolving themselves out of our method of proceeding, and if we had been able to go on, I think we should have got still more laws and have been able to have laid down for the guidance of manufacturers some definite data on which they might have worked, with the hope of getting ultimately to the bottom of the whole question. As it stands, the experiments are isolated, not classified. Nobody really knows what the true results are or the causes of those results, and it is only by meetings like these, where real attention is drawn to the subject, that we may hope that it may be taken up in a scientific way and ultimately solved. I have much pleasure in asking you to accord a cordial vote of thanks to Mr. Henwood for his lecture.

Friday, November 18, 1887.

MAJOR-GENERAL W. H. GOODENOUGH, C.B., R.A., Inspector-General of Artillery, in the Chair.

MACHINE GUNS: THEIR TACTICS AND EQUIPMENT.

By Lieutenant G. E. BENSON, R.A.

A GREAT deal has been written of late years about machine guns and the manner in which they may be employed, but unfortunately the opinions of the various writers vary to such an extent that it appears almost hopeless to arrive at any conclusion as to their use in civilized warfare without actual experience in the field.

It may, perhaps, be thought that the subject has been pretty well threshed out, as far as writing is concerned, by the various Officers who have delivered lectures in this Institution; and on that account it appears to be somewhat difficult to find any new suggestions to bring forward which may be worthy of discussion. In face of this difficulty I propose during the course of the lecture to repeat briefly the various suggestions that have been made for the use and equipment of these weapons, and give reasons for and against them, before bringing forward my own proposals. I think the great power of machine guns is too universally recognized to require any further illustrations by me, and I will therefore simply state that in practice with a 10- and 5-barrelled Nordenfelt carried on at Bangalore in August and September, 1884, before Sir Frederick Roberts, the following results were obtained:—

The 10-barrelled gun was found to fire about double the amount of ammunition in a given time (2 minutes), and obtain about the same number of hits, as fifty marksmen and first class shots at 1,200 yards range.

The 10- and 5-barrelled guns firing together for 2 minutes at 2,450 yards gave 192 hits on a horizontal target out of 855 rounds, while two 9-pr. H.A. guns which fired shrapnel for 9 minutes gave 394 hits. The striking velocity of the shrapnel bullets was much greater than that of the Nordenfelt. The angle of descent of the latter was about 20°, so that they would have reached troops behind earthworks. It was noted throughout the practice that the 5-barrelled gun did not hold its own in rapid long-range firing by reason of its want of weight and stability. This shows that apart from greater rapidity of fire greater accuracy is also obtained from the heavier

class of machine guns. In the above experiments the Nordenfelts were worked by unskilled men.

About a year ago a pamphlet on this subject was written by a M. Gustav Roos, at St. Petersburg, and he informs us that experiments in Russia have shown the following results:—

- (1.) One 5-barrelled Nordenfelt = 50 men.
- (2.) At 950 yards a single machine gun produced a greater effect than two field or mountain guns.
- (3.) From 950 to 1,700 yards a single machine gun produced the same effect as two field or mountain guns.

He lays great stress on the laying mechanism enabling fire to be continuous and effective when the front is obscured by smoke or darkness, and this I found to be of great importance in the Soudan, when laying these guns before nightfall, so as to sweep the ground in case of a night attack, thus making sure of the fire being effective in the darkness.

The two great questions on machine guns are these:—

1st. What should be their means of transport?

2nd. To which arm of the Service are they to be attached?

The answers to these two questions are dependent on each other. If they are to be attached to the mounted branches they must be able to get over the ground quickly enough to accompany them on service. For this purpose pack transport appears unsuitable, as it entails men marching on foot to lead the animals. Apart from this, pack transport has the following disadvantages:—

(1.) A long train of pack animals would be required to carry sufficient ammunition for one machine gun; for an animal can only carry on his back one-third of the weight he can draw at speed.

(2.) The heavier class of machine guns producing the best shooting (as shown by the Bangalore experiments) would be too heavy to mount on a pack animal.

(3.) The delay in coming into action and moving them short distances.

In my opinion one of the most important considerations in deciding on the method of transport of machine guns is the carriage of ammunition. Some men have urged that it is a mistake to imagine that such a large supply is required with machine guns, as they never have to fire rapidly for a long period, and in support of this theory it is pointed out that in the recent operations in the Soudan a comparatively small amount was expended. But it is forgotten that the most important fights where they have been used seldom lasted more than half an hour, which is very different from the duration of a battle between two civilized Powers. Suppose you have a machine gun on pack animals, as suggested by Major Anderson, R.H.A., in a lecture recently delivered here;¹ according to his plan, one mule is for the gun and the other for the ammunition, while a reserve of ammunition is to be provided for elsewhere. As this ammunition mule can only carry about 1,000 rounds the supply would be totally

¹ Journal, No. 138, p. 45.

inadequate, and the gun would be useless till the reserve ammunition succeeded in finding its way to the spot. On the other hand, if you have a string of ten mules to carry the 10,000 rounds per gun which are necessary even for the lighter natures, think of the number of men required to lead these mules, the size of the mark they would offer, and the space they would occupy on the line of march when this number is multiplied by the number of guns, in addition to which these long strings of pack animals are most unwieldy for manœuvring. With the gun and ammunition on wheels many of these disadvantages disappear, for (1) a heavier and therefore more powerful and accurate gun can be carried, (2) a larger amount of ammunition can be carried *actually with the gun*. (3) If drawn by horses, great rapidity of movement is attainable in such country as campaigns between civilized Powers generally take place in. (4) The limbers and axletrees afford seats for the men who with pack transport must march on foot. The principal advocate of this kind of equipment has hitherto been Lord Charles Beresford, who recommends it as combining great rapidity of movement and a plentiful supply of ammunition.

It has been suggested (notably by Captain Armit¹) that these weapons should be mounted on light carriages drawn by infantry. The arguments against this method are, I think, patent to everyone. The most obvious are:—

(1.) The enormous labour of dragging these guns in a campaign. Men usually have enough to do to drag themselves along without making them pull a gun as well, and their strength may be far more usefully applied than by turning them into draught animals.

(2.) Sufficient ammunition could not be carried with the gun.

(3.) This style of draught would give the machine guns the least possible mobility, while what is required for every arm is the greatest possible mobility.

Another system, which is now being tried in several cavalry regiments, is to mount the gun on a two-wheeled limber, with the ammunition underneath the gun. It is intended to be fired without unhooking the horses by two men on the limber. This system has certain points in its favour—notably its mobility and readiness in coming into action. But I think a good many will agree with me in urging the following objections to it:—

(1.) That sufficient ammunition cannot be carried, probably not more than 2,000 rounds at the outside, which would not last more than six or seven minutes in rapid firing.

(2.) The breathing and motion of the horses would impair the accuracy of the fire; anyone who has seen a battery of artillery after a gallop for half a mile will readily understand how the blown horses move the limbers.²

(3.) Supposing a horse were hit, the gun would be put out of action

¹ Journal, No. 133, p. 37.

² This objection has been met by Mr. Nordenfelt by taking the weight of the shafts off the horses by means of a prop on coming into action, but this does not affect the other objections in any way.

till the horse was extricated. The limber may act as some sort of protection from frontal fire, but not when fire becomes in the slightest degree oblique, and the gun might thus be put out of action at the moment when its fire is most wanted. Besides this, the mere falling of bullets or shell near the horses would cause them to become unsteady and spoil the shooting.

(4.) The gun cannot be detached from the limber to be run up into a position, either where horses cannot go on account of rough ground, or where it is desired to run the gun up the reverse slope of a hill just far enough to be able to fire over the top and not be seen by the enemy when coming into position. If the horses take them up under these circumstances they would form a large object with the limber and probably be seen at once.

(5.) Difficulty in getting cover for the gun thus mounted when used in the defence of positions, for the great height of the gun from the ground (nearly 6 feet), and the size of the limber would make a very large epaulement necessary to hide it. On the other hand, of course, the extra height would enable it to fire over a higher parapet which would give more cover to the men.

Now if we put the gun on an ordinary light gun-carriage with a trail hooking on a limber the above objections disappear, for an increased amount of ammunition can be carried by means of axletree boxes on the carriage, while the limber, no longer hampered by the gun on top of it, could carry an increased number of rounds. The gun would be fired with the trail resting on the ground, and could be one of the most powerful class. The importance of this latter consideration is sufficiently seen in comparing the practice of the 5- and 10-barrelled Nordenfelts at Bangalore in the experiments previously referred to, the 10-barrelled gun proving itself more than twice as powerful, and more accurate at long ranges than the 5-barrelled gun. It is also evident that the horses could be placed under better cover, and when one was struck it would not interfere with the fire of the gun, as in the case of the gun being mounted on the limber. The gun could also be detached from its limber and run up into positions required, say, up the steep reverse slope of a hill, while the horses and limber would remain under cover further down the slope in rear.

The chief objection urged against this method of mounting is the weight and consequent number of animals required to drag the gun, and the consequent expense in equipping them. But I will endeavour to show that though this method is apparently the most expensive, it is in reality the most economical. For the sake of argument we will take the Nordenfelt 10- and 3-barrelled guns, and assume that the heavier gun with its 10 barrels is only three times as powerful as the 3-barrelled gun, thus making three 3-barrelled guns capable of delivering the same amount of fire as the single 10-barrelled gun. The latter, weighing over 2 cwt., cannot be carried by pack animals, while from its breadth it cannot be mounted on a limber without taking up most of the room required for ammunition. The 3-barrelled gun is the weapon recommended for pack transport and for mounting on a limber. The 10-barrelled gun mounted

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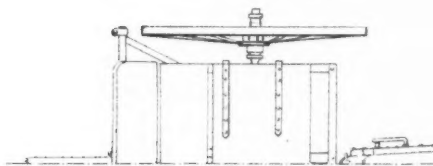
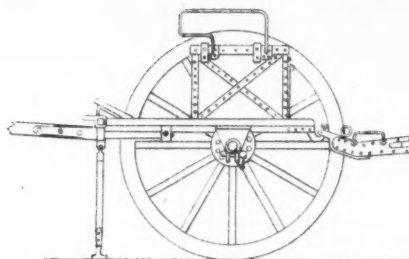
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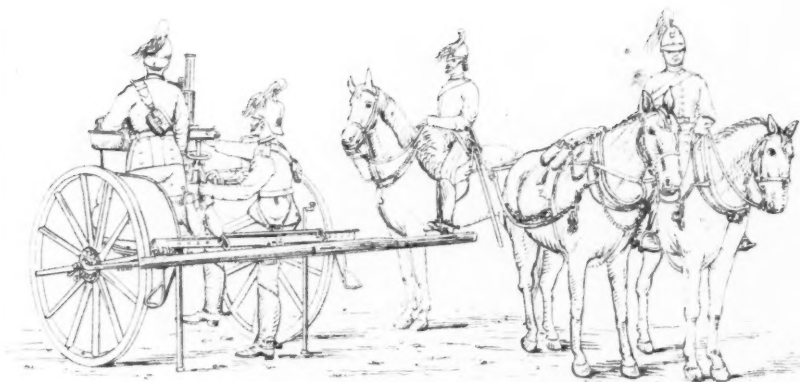
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MACHINE GUN

(NORDENFELD)



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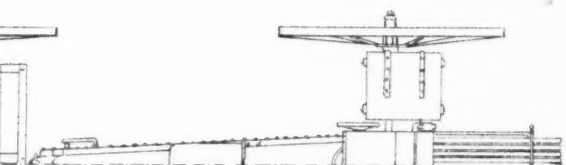
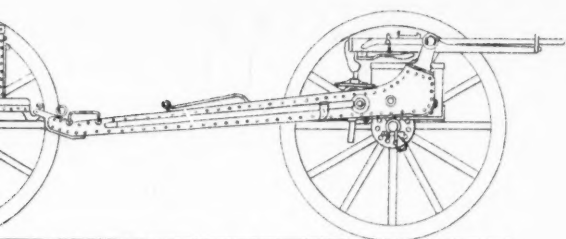


MACHINE GUN FOR CAVALRY

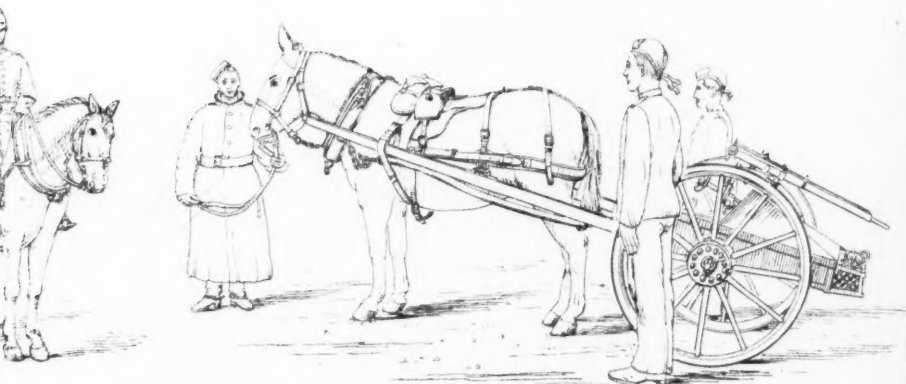
FROM PHOTOGRAPHS

MACHINE GUN FOR ARTILLERY.

(NORDENFELT CARRIAGE.)



$\frac{1}{32}$ Size.



MACHINE GUN FOR INFANTRY.

PHOTOGRAPHS TAKEN AT ALDERSHOT.

on a field carriage with limber, the whole carrying 5,000 rounds and three men on the boxes, weighs about 25 cwt., and therefore can be drawn at speed by four horses. Add a horse for a N.C.O. in charge, and we have a total of five horses, one N.C.O., three men on the seats, and two drivers. A 3-barrelled gun mounted on a limber has with it 1,546 rounds and two men, takes two horses to drag it and one N.C.O. on another horse to look after it. Three guns mounted like this, having altogether 4,638 rounds, will therefore take—

9 horses,
3 N.C.O.'s,
6 men, and
3 drivers.

While in the former case we have—

5 horses,
1 N.C.O.,
3 men, and
2 drivers,

thus showing a saving of four horses, two N.C.O.'s, three men, and one driver. This is a very considerable saving, while as regards space occupied on the march, in camp and on the battle-field, and ease of control of fire, the single powerful 10-barrelled gun has an immense advantage over the more numerous but less powerful 3-barrelled guns. Comparing the same guns when the 3-barrelled gun is carried on mules, the advantage of the 10-barrel is still more decided, for four mules are required for the gun and carriage and about 1,500 rounds, thus making twelve mules necessary for three such guns, while at least six men per gun or eighteen in all would be required for mounting and dismounting the guns and looking after the mules. We thus have eighteen men and twelve mules against six men (two drivers) and five horses. Of course a much larger supply of ammunition than the amount above mentioned is necessary, and this *must* be brought up on wheels unless the country is impracticable, in which case the organization would be more that of a mountain battery. Yet another point in favour of the gun-carriage and limber principle is that you have a good supply of ammunition *close at hand*, the immense importance of which is fully brought out and impressed on us by Prince Hohenlohe in his letter on the supply of ammunition during the wars of 1866 and 1870-71, recently published in the R.A. Institution papers.

Having argued out the question of transport thus far, and fixed on a style of carriage (see Plate) which combines three great desiderata, viz., (1) extreme mobility; (2) considerable ammunition supply; (3) a steady platform from which to fire the gun, we now come to consider the tactical organization of these weapons. In order to do this properly, it will be necessary to, so to speak, *analyze* the fire of machine guns.

Without again going into the detail of any experiments, I will point out the following characteristics of their fire:—

(1.) The great power of concentration and rapidity of fire, which enables them to do a great deal of damage at a given point in the shortest possible time.

(2.) Power of turning the stream of fire at will in any direction required *during the actual firing*.

(3.) The continuity of their fire, *i.e.*, the fire goes on continuously without any stop for laying after every round as in the case of the infantry rifle and the field gun.

(4.) The great control of fire, owing to the whole of the firing in each gun being done by one man.

The first of these is equally characteristic of artillery, and is due, generally speaking, to the fact that in a battery, taking a gun as a unit, there are only six units to direct, while in a battalion there are 1,000 units or so, of which perhaps 300 are in the fighting line; and here the front over which they are extended is much greater than in a battery, thus making supervision still more difficult. No. 2 is a characteristic belonging to machine guns alone. No. 3 belongs only to a machine gun as a weapon, but this continuity of fire is of course also attainable by the other arms when there is a sufficient number of them. No. 4 applies equally to artillery and machine guns, and results from the small number of units in one command.

From the above we gather that there are some useful qualities pertaining to machine-gun fire which are not shared equally by that of the other arms, and it therefore behoves us to use these weapons in such a way as will bring out these qualities and make the utmost use of them. The effect of fire is said to depend on two things, *viz.* : (1) its suddenness; (2) its intensity. The latter is a quality evidently possessed by machine guns, but it has not necessarily the former, as the suddenness depends on the circumstances of the case, and whether it is expected or not. Clearly then to make this fire unexpected and sudden, it is necessary to make the weapons as mobile and as capable of rapid movement as possible, so that they may be *placed in the required spot at the required moment*, which means practically, if accomplished, that their fire will be *sudden and unexpected* by the enemy. For instance, they might be required to gallop off in order to check an attack at a threatened point, or seize a favourable opportunity for enfilading the line of the enemy, whether of guns or infantry. The *intensity* of their fire makes them capable of doing such an immense amount of damage in a short time that their power of rapid movement increases tenfold their power and moral effect. There is still another point about these weapons which I think is worth noting; it is the difficulty of distinguishing their position at long ranges when infantry are firing alongside of them. To illustrate this I may mention that at the Easter sham fight at Dover this year, I was with the attacking force, and when my battery came into action in the most advanced artillery position, about 800 yards from the defenders, I could distinctly hear the well known rattle of their Nordenfelts, but could not be certain where they were, as the smoke caused by them was the same as that caused by the musketry fire, whereas the smoke of artillery, even at a much longer range than this, at once betrays the position of

the guns. If smokeless gunpowder could be introduced, it is evident that the position of the machine-guns would be still more undistinguishable.

I think I may assume that the value of these weapons in the defence of fortresses and fortified positions is too universally recognized to require further comment. It is their use in the open field about which there is so much controversy.

No doubt in 1870-71 they were a failure, but their failure is attributable to the following defects:—

(1.) The imperfect nature of the weapon used.

(2.) Want of training on the part of the men. They took the guns direct from the arsenals to the field of battle without any previous training.

(3.) Misapprehension of their tactical use. They seem to have been placed in line of battle to contend with artillery at ranges at which their own fire was comparatively powerless, and were thus easily destroyed instead of being reserved under cover for ranges where their fire would be more effective. As in most of the battles in that war the French stood on the defensive, we have no example of their being used on the offensive.

The ranges at which machine gun fire is most decisive in its effects compared with that of other arms are probably those between 800 and 1,600 yards, and in future wars it appears that battles are not unlikely to be decided at those ranges. Under 800 yards the power of infantry fire increases very rapidly, and over 1,600 yards that of machine guns diminishes so much that they would be overwhelmed by artillery fire. Thus the machine gun cannot supply the place of skirmishers nor yet that of artillery, but would play a very special rôle when occasion required, *whenever it could be brought into the required position at the right moment.* M. Gustav Roos supports this theory and says that—"The machine gun constitutes a special arm, having its own definite sphere of action, within the limits of which the enemy is struck in the most advantageous manner by the weight of metal projected, and with a smaller loss of time and men than in the employment of any other arm whatever."

I think it is pretty plain that if I have correctly analyzed the fire of machine guns there are several very important differences between the conduct and control of that fire and that of infantry; in fact the only point in common appears to be that they both fire bullets of the same pattern; for I maintain that there is a very important difference in the effective ranges of the rifle and the machine gun when the former is handled by large bodies of men which are very difficult to control in extended order in the excitement of the battle. Machine guns can, from the control under which they may be held, open fire with effect at ranges where a very large proportion of the infantry ammunition would be wasted. In this control of fire and power of concentration on one object they resemble artillery, but have not sufficient range to contend successfully with that arm except under certain conditions. A point where they have the advantage of artillery is that there being no recoil, they can come into action on a steep

reverse slope where, if field guns were fired, the recoil would send them to the bottom of the hill. The fact that they can keep up an effective fire when the front is obscured by smoke or darkness, provided they have been previously laid, has already been noted. They also share with artillery the bad quality of powerlessness during movement, for anyone who has sat on a limber going at speed over rough ground will realize the impossibility of firing when in movement. The men have enough to do to hold on without having to fire a gun as well. Machine guns can, however, from the simplicity of their ammunition, come into action quicker than artillery.

With cavalry the machine gun has nothing in common except, perhaps, its power of rapid movement, for cavalry are supposed to act by shock while machine guns act by fire alone.

Since these weapons have so little in common with the other arms, it might appear that we are as far off as ever from settling the question as to which arm this weapon is to be attached. On the contrary, I think we are now near a solution of the problem.

Cavalry and artillery are generally recognized as the auxiliary arms, the use of the former being to gain information on which the infantry may act, to protect the flanks of the infantry when engaged, and to pursue the enemy when beaten by the infantry; the use of the latter being to prepare the way for the infantry by bombarding the enemy's position, and to follow up the enemy's retreat and convert it into a rout by the fire which is brought into play by means of their rapidity of movement. Therefore naturally we must look on machine guns as another auxiliary arm invented by modern ingenuity, just as cannon were invented by the ingenuity of men some centuries ago and made part of the fighting forces of the period.

Let us examine the different stages of a battle, and note the various rôles of the machine guns in each stage. As the two armies approach each other the hostile cavalry meet. This is the preliminary or reconnoitring stage, and one drives the other in till checked by the enemy's infantry. Machine guns can evidently be given the mobility necessary to accompany cavalry, and their rapidity of fire and readiness in coming into action would enable them to act with the greatest effect during the very short time the hostile bodies are in the act of approaching each other before charging. In conjunction with horse artillery and dismounted cavalry, they might even drive back the first infantry outposts of the enemy met with, the machine guns approaching to effective range, covered by the fire of the horse artillery.

During the preparatory stage of the battle, when the artillery are bombarding the enemy's position, the machine guns might be drawn up *écheloned* in rear of the flanks of the line of guns, themselves out of fire, but able to prevent by their fire any dashes made by bodies of the enemy's cavalry on the flank of the guns. When the enemy's attention was thoroughly engaged by the artillery duel, and the battlefield obscured by smoke, opportunities might occur for them to make a dash forward, accompanied by cavalry, to close range, if possible on a flank, and if successful the damage done to the enemy's gun teams and gunners in a very short space of time would probably

be enormous. However, they cannot well be used against artillery with success unless they can take it by surprise or in flank within 1,700 yards or so; but under these conditions the dismay and confusion this sudden hail of lead would cause can well be imagined.

Modern firearms and discipline have made it more than ever necessary to beat down the courage and reduce the numbers of the defenders of a position before the infantry can advance to the assault, and in this duty machine guns could render important services in the later stages of the bombardment when the artillery of the defence is more or less silenced. When this is accomplished, the machine guns might approach to a range of from 1,200 to 1,600 yards with comparative impunity, and from a position on the flank of the line of their advancing infantry, they could pour in a storm of bullets which would search out the defender's shelter trenches, and could not but cause many casualties. It is probable that the supporting fire of machine guns could be kept up longer than that of artillery, as there is no such variable quantity as a fuze to be taken into consideration with the former weapon, and thus the infantry would receive more support at the time it is most wanted. When their fire is masked, they would turn their attention to beat off counter-attacks, and fire on other supporting bodies of the enemy till a foothold was obtained in the position. Then they would advance, as the artillery do, to confirm the success of the infantry, and hold the position gained till the infantry had again been got into hand. Their rapidity of movement, readiness in coming into action, and continuous murderous fire would enable them to do this most effectively, and perhaps in no other rôle will their effect be more felt than in this. At this and other periods of the battle no doubt great opportunities would occur at times when machine guns could advance close up and sustain their wavering infantry at critical moments, just as the German artillery did in the war of 1870-71, by firing case and shrapnel with the fuze bored very short; but the superior man-killing power of the machine guns at these short ranges, and the fact of their being smaller marks to fire at—having a less number of horses and men for the same number of guns—would make them appear most suitable for such tactics.

In pursuit of the enemy, or retreat in face of the enemy, the above-mentioned qualities will serve in great stead the army which makes use of these weapons. At this last stage the defenders, whether retreating or being driven out of their position, or advancing after having repelled the attack, will generally be in fairly close formation, and thus make the close and concentrated fire of machine guns most deadly.

In the manner I have indicated, they might perform efficient service to all arms in turn. In order to be always on the spot for the carrying out of these duties, it might appear necessary to attach them to all three arms, or at any rate to the infantry and cavalry. But this would make it necessary to have too great a number of them altogether, and therefore for the sake of economy and simplicity it appears advisable to hold them under the hand of the General in

command of each Division, so that they might be told off to work with each arm as might be required. In fact they should act in conjunction with whatever arm happens to be playing the most important part in the different stages of the fight—with the cavalry in the preliminary stage, with the artillery to protect their flanks in the preparatory stage, with the infantry during their advance and assault, and again with the cavalry for the pursuit or retreat.

In order to use them in this way they would have to be organized in troops of say four guns each. I say "troop" in preference to the word "battery," because a "battery" expresses a force which batters or bombards material obstacles, whereas a machine gun is only a man-killing weapon. Each troop would consist of four guns and four ammunition wagons or carts, which should always accompany the guns on the line of march. Prince Hohenlohe in his letters lays great stress on this for artillery, and his reasoning will apply equally to machine guns. The guns would require four horses each, and if wagons similar to artillery ammunition wagons were employed they would require the same number, but probably a light S.A.A. cart drawn by two horses would be preferable, though of course the amount of ammunition carried would not be so great.

I have reckoned the war strength of a troop as above described to be as follows, allowing for store wagons, spare horses, &c.:—

With ammunition wagons.

Men.	Horses.
54	70

With ammunition carts.

Men.	Horses.
50	62

Three such troops might be attached to each Division, and perhaps two to the cavalry Division, making eleven troops per army corps.

The war strength of three troops, with ammunition carts, would be (allowing one forge and six horses per three troops)—

Men.	Horses.
153	192

For purposes of comparison I may say that the war strength of a battery of horse artillery is—

Men.	Horses.
182	183

Probably a peace strength of thirty horses per troop would be sufficient. Each troop would be capable of delivering a fire of 4,000 rounds per minute, though it would be seldom that this rate of fire would be required.

I don't know how many rounds the fighting line of a battalion of infantry could fire by volleys per minute without getting out of hand, but probably it would be about 1,500 rounds, allowing about five rounds per minute to every man in the fighting line.

Attached to the cavalry Division in front of an army, the value of

such troops of machine guns is undeniable for holding important points seized by the cavalry before the infantry come up, and for acting on the enemy's cavalry just before the charge as previously pointed out. They would furnish the fire power which no doubt is now necessary to accompany cavalry, and to provide which it is thought advisable to organize corps of mounted infantry, though, if the latter are also to be used for outpost duty and scouting, machine guns could not of course supplement their duties in that respect.

In support of the above views I will quote some of the remarks made by Colonel Andrewes, R.H.A., who was present at the experiments carried out at Bangalore previously referred to. Among other things he says:—

"That their power of mobility on carriage or pack transport would admit of their taking an important part on special occasions with cavalry or mounted infantry in holding bridges, fords, causeways, &c., &c., pending the support of infantry, and that they would also prove of good value on outpost.

"That they should have a distinct organization, each gun being under a well-approved warrant officer, and that they should take their place with any force in the field massed in battery under a Staff Officer, parked with the corps artillery, and held at the immediate disposal of the General Commanding, for distribution by him to regiments of infantry or cavalry as occasion might present, or for disposal at his discretion at any critical and suitable time or place.

"They would appear to have their greatest value on the defensive as a multiple of infantry fire, against assault of position, entrenched or otherwise. Their moral effect is great, and should it be ultimately decided to attach them more permanently to battalions, I think they would occasionally prove a valuable auxiliary to infantry and artillery in co-operation, by falling back to the positions taken up in succession by the latter arm to cover a retreat, and offer rallying points for the force."

With reference to the first part of this last paragraph, I may remark that it is an axiom laid down in all works on tactics that *all* firearms are more powerful on the defensive, and I don't see any reason why the value of machine guns on the defensive and offensive respectively should vary any more than that of other man-killing firearms.

The above sketch of the tactics of machine guns principally deals with their use on the offensive, about which perhaps there has been more controversy than on the defensive, for everyone, I think, recognizes their great value in the latter case.

Their tactics in a battle fought on the defensive would be somewhat as follows: In the preliminary stage the defender's cavalry would probably be weaker than the attacker's, but the presence of a few machine guns with the former used as before described might prevent the latter gaining much advantage. When the defender's cavalry fall back on their infantry outposts and advanced

posts the machine guns would certainly check the enemy's advance, the chief point to be observed being that they should remain as far as possible under cover until the enemy, whether infantry, cavalry, or artillery, should approach within effective machine-gun range, for if they fire at long ranges against the attacker's artillery they would be liable to be destroyed. If ordered to retire on the main position their services there would be rendered much in the same way. Further comments on their use on the defensive are perhaps unnecessary, but it may be expected that their great mobility would be turned to good account in making counter-attacks on the flanks of the attackers, and in enabling them to be held in central positions intact till it is absolutely certain on which points the enemy's main attacks will be delivered. If these weapons were drawn by infantry on light carriages these rapid changes of position would be quite impossible, and their sphere of action would therefore be very limited. Amid the dust and smoke of a battlefield these movements would not readily be noticed till a stream of bullets would suddenly appear from an unexpected quarter, and once the range is found, a few minutes' fire from these weapons means annihilation.

Long-range infantry fire has of late assumed an importance hitherto unthought of, but there are so many disadvantages connected with it, *e.g.*, in the men getting out of hand and the expenditure of ammunition when it is difficult to distribute a fresh supply among an extended line of men under fire, that the use of this fire is by no means an unmixed advantage. Perhaps machine-gun fire is the best sort of long-range infantry fire on account of its greater accuracy and the comparative ease with which the supply of ammunition can be renewed, as it has not to be distributed among so many units.

Proposals have frequently been made for making machine guns actually part of an infantry battalion and cavalry regiment. It is proposed to attach a certain number to every infantry battalion, in order to supplement the fire of the battalions, because a machine gun is called a cluster of rifles, but we have never yet heard of any sound scheme for their use in action when so attached. They cannot possibly accompany the shooting line of the attackers in action, for they would at once become a conspicuous mark for the defenders, as they cannot lie down and fire as infantry do. Moreover, if carried on mules and the mules be shot, the gun would be practically useless, as it could scarcely be expected that the men would bring it along, and then again comes the question of carrying a large amount of ammunition under close infantry fire. If mounted on wheels and drawn by mules or horses, it would soon be rendered stationary by the same fire; and the reasons why it cannot be drawn by infantry have already been given. On the other hand, if placed to a flank about 1,000 to 1,500 yards from the enemy to perform its functions as long-range infantry fire covering the advance it would be a long way from the battalion it belongs to, and therefore completely out of control of the Officer commanding the battalion. If worked thus away from the battalion, the Commanding Officer would have to detach from his

probably already too weak battalion a certain number of Officers and men to look after weapons over the service of which he would no longer have any control. This idea is simply a revival of the old battalion gun system which was proved long ago to be entirely vicious.

Again—suppose the battalion to be acting on the defensive—the machine guns would be placed to defend special points, such as salients, to sweep roads, &c. In this case is there any advantage in having them as part of the infantry battalion? I say certainly not, for they would perform those duties equally well if they did not belong to the infantry. Would it not rather be probable that if belonging to a battalion in a defensive position, and that battalion were to become unsteady, the same unsteadiness would affect their comrades with the machine guns, whereas if they were distinct from each other there would be a sort of rivalry between the riflemen and the machine gun men as to which would hold on to the position the longest. Much the same kind of reasoning applies to the case of their being attached to regiments of cavalry. If they are to be used with cavalry, as I saw the gun of the 10th Hussars used the other day at the Agricultural Hall, viz., to fire on the enemy's cavalry from a flank just before the charge of the two hostile bodies, why should not horse artillery be so attached, and yet if such a thing were proposed it would be received with ridicule.

Imagine a cavalry regiment sent off on reconnoitring duty over very rough country, which though passable for horses was so in a much less degree for wheeled carriages, or ordered on any duty where machine guns were not required. What would the regiment do with its machine guns? It must either leave them behind, in which case the regiment must be split up, or else they would hamper the movements of the rest of the regiment by causing it to wait for them in difficult places, or they would have to carry them on pack animals, in which case a total change of their equipment would be necessary, at the expense of having a greater number of animals than ever.

It was once proposed to attach them to batteries of artillery. But I believe this project has long ago been given up. In fact it was most probably this very proposal which led gunners in the first place to set their faces against these weapons.

Such organizations as these are opposed to all the lessons of war and to all ideas of that simplicity which is so essential in warfare—the Officers and men of such corps would be required to know everything about their arms, and thus their work would be doubled, or else the special Officers and men selected for the machine guns would be left to themselves, and practically constitute a separate unit.

In addition to this the principle of concentration of fire of several machine guns at once on certain localities must be kept in view, and it could not be managed if in order to do so it were necessary to collect the scattered little machine guns from the various battalions and regiments, for that would take up valuable time, and even when massed together (as suggested in Major Anderson's lecture) the want of previous practice in working together would make proper

regulation and control of fire an impossibility. It is easy enough to get forces to act separately which have been trained to act together, but it is a very different matter to get those to act together who have only been taught to act separately.

Their method of working when supporting their infantry would probably be something after the mode at present recommended for artillery, viz., to direct a concentrated annihilating fire in turn on the various portions of the line to be attacked. The necessary fire discipline to accomplish this would be absolutely unattainable with a heterogeneous mass of little machine guns from the various battalions without any organization in units or any chain of responsibility. The three powerful troops of divisional machine guns that I suggest would deliver a fire equal to that of three dozen of the light machine guns which could be carried on mules or pulled by infantry, while in the fire discipline of the two forces and the space of ground occupied, there would be no comparison. Again, after the action was over, imagine these unfortunate machine guns attempting to join their regiments and battalions again in the confusion of victory or defeat. Of course in thinking out these things we are obliged to bring such practical considerations as these to the front as well as theoretical ones. To those who have read the accounts of modern European wars, it appears quite possible that the poor little machine guns would not find their own battalions till some days afterwards.

In the foregoing pages I have been treating almost exclusively of warfare against civilized nations in the fairly open country where it is usual for campaigns to take place.

In fighting in uncivilized countries against savages these proposals would have to be largely modified according to the practicability of the country and the nature of the savage tactics. For instance, against such foes as fanatical Arabs or Zulus who almost invariably act on the offensive, thus causing us to act on the defensive, the offensive power of machine guns is not required to be made much use of. In addition to this the barren and impracticable nature of the country usually compels the number of transport animals to be cut down to the lowest possible limits, and the short duration of fights against charging savages renders it unnecessary to have so large a supply of ammunition with the gun. Therefore, we must have an equipment suitable to these changed conditions. If pack transport alone can be used something in the nature of mountain battery equipment would meet the case, and the guns would have to be lighter and less powerful. As the ranges at which these sort of fights takes place are usually short the inferior accuracy of these light weapons at the longer ranges would be of little consequence. It would be advisable, however, whenever the nature of the country permitted it to have the guns and ammunition drawn on wheels on account of the consequent saving in animals, and as they would usually be used on the defensive it would not be so necessary to give them the great rapidity of movement which is so useful in civilized warfare.

Captain W. N. Lloyd, R.A., organized a troop of four Gardner guns on the mountain battery principle during the recent operations in Burmah, and an interesting account of the equipment of this troop was sent by him to the Royal Artillery Institution papers some months ago. In it he recommends for the four guns an establishment of fifty-two Officers and men besides a native establishment for the mules. This, he remarks, is about half the establishment required for a 4-gun mountain battery. He points out the great value of the machine gun fire for searching out the position of the dacoits in the jungle and for playing on their line of retreat when driven from their stockades or villages, and I have General Sir G. White's word for it that these weapons did good service when called upon.

In conclusion, I would point out that it is of little use our writing and talking about machine guns and making proposals for their equipment and tactical use, unless we take measures to have these proposals tested by experiment as far as can be done in time of peace. It is also of little value trying one gun here and another there without any attempt at making them work together; what we want is to try their *combined* effect under service conditions and at targets representing such objects as would be fired at on service. Moreover, the N.C.O.'s and men must have some preliminary training before conducting any experiment, in order to make it a fair trial, and trained range-finders must be supplied, for without them there is considerable difficulty in finding the range on damp soil or turf, though on dry soil the dust knocked up by the bullets is sufficient guide. This difficulty in finding the range is no doubt the chief bar to the efficiency of machine-gun fire. To obviate it perhaps some small gun firing an explosive shell might be carried and used to find the range just as common shell are used with artillery. With the equipment and training of men complete we could compare the effect of machine-gun fire with that of infantry and artillery at the various ranges, and from the results obtained get a more correct idea of their value in the field whether used singly or working together. In order to accomplish this I have the following suggestions to make: There are a large number of 4-gun batteries in the artillery armed only with the obsolete 9-pr., which we may be pretty sure will never again be sent on service. Suppose these guns be taken away from one of these batteries for a time, and machine guns supplied in their places; there would be sufficient horses and men in one battery to fit out two machine gun troops for experimental purposes; after a little training a regular series of experiments might be carried out as far as possible under service conditions against targets representing troops of all arms and in various formations, men in shelter trenches, &c. This experiment would cost little beyond the fitting up of the guns and carriages and the expenditure of ammunition, and could not but be most interesting and valuable in its results.

In advocating the use of machine guns in the field, I wish it to be distinctly understood that I do not consider that they can supply the place of either infantry or artillery except under certain conditions, but that by their own peculiar power at certain ranges they may

decide a battle in favour of the army which possesses and *knows how to use them*. I, therefore, do not advocate their introduction at the expense of reducing any other arm, but am of opinion that they should be brought in *in addition* to the other arms.

I will now conclude by reading an extract from the official report by the District Inspector of Musketry on some Machine-gun Field Firing which has recently taken place at Aldershot. The first extract is from a report on the mounted competition at the Army Rifle Meeting, and is as follows:—

“In the mounted competition of this meeting a section of four men were required to ride over a course of about 800 yards over four fences, three men being required to dismount at points 600 and 400 yards from the target and fire four rounds, and each section was allowed seven minutes to complete the course. As the cavalry Nordenfelt machine-gun has three barrels, and the gun is served by three men, it was thought that by putting the guns over the same course as the mounted sections an interesting and useful comparison could be made between the two descriptions of fire.

“The best mounted section recorded 21 hits on the target out of 24 rounds fired. The best machine-gun recorded 3 hits out of 80 rounds fired.

“The cavalry guns were fired from galloping carriages without removing the horses. The *very bad* results are attributable to the movement of the horses, and *prove very decidedly* that so long as horses are attached to the gun, effective fire cannot be produced.

“The infantry machine-guns were put over much the same course and allowed the same time; the result of their practice was very good, viz., 49 hits out of 80 rounds; in their case the mule was detached from the gun when brought into action.

“The cavalry gun-carriage is provided with a centre pole and the infantry gun with shafts which rest on the ground when the mule is removed, acting as a trail to steady the gun.”

I think this report fully bears out my opinion of the cavalry galloping carriage. If the infantry had only to unhook the trail from the limber instead of unhooking the mule they would have had much more time for firing, and therefore made still better practice.

I will now read an extract from a letter from Colonel Ward Bennitt, commanding the 5th Lancers at Aldershot, to which regiment a 3-barrelled gun on a galloping carriage has been for some time attached. He says: “I disapprove of machine-guns being attached to cavalry regiments, for a Commanding Officer has quite enough to do to look after 400 men and horses when manœuvring in the field without the extra responsibility of the machine-gun.” Then again he adds, “to fire a gun with panting horses attached is an *absurdity*, so that a proper carriage is *essential*, and the present two-wheeled one is useless.” Here again I think my views are supported.

Colonel the HON. R. A. T. TALBOT, C.B. (1st Life Guards): I have been asked by Colonel Liddell, who until a few weeks ago was in command of the 10th Hussars, to read a paper which he has written upon this question.

The CHAIRMAN: I am afraid I must tell you that the Council of the Institution

do not think it desirable that papers from absent members should be read as contributions to a discussion. The idea is, that at any discussion the person who makes a statement shall be present, to give any explanation of that statement, and to receive the reply which it elicits. If, however, there is anything in the paper which you can state from your own knowledge, we shall be most happy to hear it.

Colonel TALBOT: I am very sorry I was not aware of that rule, or I should have prepared myself to have more perfectly given the views of Colonel Liddell upon the subject. It is probably well known that the only real and exhaustive trial of machine-guns that has taken place with cavalry is due to the exertions of Colonel Liddell, a gun having been attached to the 10th Hussars for the last two years. It is owing to those experiments that many improvements have been made in the present gun-carriage, and in various matters connected with the gun, which could not have been effected without a practical trial. I will endeavour, as briefly as I can, to give my views (which are mainly in accordance with those of Colonel Liddell) as to the lecture given to-day, confining my remarks chiefly to the use of these guns with cavalry, because I think there are many Officers present more competent than I am to discuss their use with other branches of the Service. I therefore turn at once to the remarks the lecturer has made as to the use of the gun with cavalry. He says first of all: "It is intended to be fired without unhooking the horses, by two men on the limber." Now, I think that is not altogether an accurate statement. It is not intended always to fire without unhooking the horses from the limber, but on occasions it might be so. Where there was time, undoubtedly the horses would be unhooked from the carriage, with the object of putting them under shelter, and also that the gun might not be affected by any movement on the part of the horses, although the disadvantage of such movement had been very much modified by the prop which Mr. Nordenfelt had added, which made the carriage almost steady, even if the horses were not motionless. I therefore think it ought to be considered that as a rule the horses would be unhooked from the gun. The first objection taken by the author to the two-wheeled carriage is, "That sufficient ammunition cannot be carried, probably not more than 2,000 rounds at the outside, which would not last more than six or seven minutes in rapid firing." In the first place, I do not see that it need be put at 2,000, because I can see no objection at all to having a subsidiary carriage for carrying the ammunition, and as much as 10,000 or 15,000 rounds might be so carried. But if it were so, I think there can be no dispute as to the enormous importance of being able to bring a very heavy fire to bear for six or seven minutes, even if it could not be prolonged. I have already touched upon the second objection, that "The motion of the horses would impair the accuracy of the fire," because, as I have said, the horses would not be as a rule attached to the gun when firing. The third objection raised is, that "Supposing the horse was hit, the gun would be put out of action till the horse was extricated." That also is met by the fact that the horse would probably not be in the carriage. Of course under every circumstance accidents may happen, even in field batteries, but if only one horse is hit and you have your other horse sound, he would be quite competent to take the carriage out of fire. There would also be the corporal's horse, no doubt provided with traces. Probably the regiment would not be very far off, and would be able to provide a trace horse or horses (with lasso equipment), and so you could take the gun away almost as quickly as if it had its complete team of horses. The fourth objection is, "The gun cannot be detached from the limber to be run up into a position." I cannot see the force of that objection at all. Two or three men can readily move one of those light guns, but the horses before they were detached, naturally would take it up to the position, and then if it was only a question of a few yards, the men could easily push it into its proper place. The fourth and fifth objections depend very much upon the lightness and mobility of gun and carriage, and with a light gun on a two-wheeled carriage almost disappear. The fifth objection is, "The difficulty in getting cover for the gun thus mounted, when it is used in defence of positions." I think the lecturer answers that himself by the later part of the paragraph, in which he says: "The extra height would enable it to fire over a higher parapet, which would give more cover to the men." My opinion about this gun is, that its most essential feature is its mobility, and anything that sacrifices or impairs that quality

reduces by so much the efficiency of the gun. I attribute greater value to mobility than to weight of fire, or even to extreme accuracy. The great thing is, that it should be able to keep up with cavalry, to go forward and take up its position, or to retire from that position with the same rapidity with which it took it up. Although I do not wish to go into the technical matter as to which particular pattern of gun is desirable, I think this feature ought to be borne in mind, that lightness of gun and carriage is one essential qualification. In a later part of the lecture, Lieutenant Benson says: "Imagine a cavalry regiment sent off on reconnoitring duty over very rough country, which, though passable for horses, was so in a much less degree for wheeled carriages." From what I have seen of machine-guns there are very few places indeed which the gun could not go over, and I think that objection is really not a very valid one. We all know the marvellous manner in which horse artillery guns are able to go over the country, and of course from their lightness and handiness, being between two wheels only, machine-guns would be enabled to go over places where certainly horse artillery guns could not go. The lecturer has so very fully gone into the various occasions upon which this gun could be most usefully employed, that I do not propose to go into that part of the question. I think his remarks are very exhaustive on this point. It is almost impossible to overrate the enormous importance of the position which these guns may take in future actions where cavalry are engaged, and my opinion is, that their part is with cavalry more perhaps than with infantry or artillery; although with the latter the necessity of a cavalry or infantry escort would often be obviated. I may say this, that I think in the case of infantry attack, machine-guns would be of very little use, but where cavalry is attacking, they might be of use. But with all arms, for covering retreats, and for protecting important positions, such as bridges, temporary entrenchments, and for detached duties, I think the value of these new weapons can hardly be overrated. There is, however, one point on which I must rather differ from the lecturer, and that is where he advocates the formation of these guns into troops. Those who heard what the Adjutant-General said this year as to the great difficulty he had in getting the War Office to sanction increased expenditure, even in matters of paramount importance, will see that that is a very considerable drawback to the idea of forming batteries or troops of these guns; but by attaching one or two, or more guns to each cavalry regiment, there would be absolutely, in times of peace, no additional expense, except that of the gun itself. That point should be taken into consideration, whether it would be ever possible to induce the War Office to establish what would be practically a new branch of the Service, with its attendant expenditure; but there would not be the same objection to allowing guns to be attached to each regiment. On active service these machine-guns would of course be at the disposition of the Corps or Divisional Commander for employment in any way that might be thought proper.

Major W. W. M. SMITH, R.A.: My only title for speaking on this subject is this—I have not had actual experience with machine-guns, as the lecturer has done, in the battlefield, but it is a subject to which I have given a great deal of consideration, and it so happened that last summer, when a great many miles away from here, about the same time that I suppose the lecturer was preparing his address, I was engaged in writing a paper of my own upon this very subject. I regret that the Council of the Institution have, as I understand, felt it right that this particular discussion should now be drawing to a close. They have undoubtedly assigned a great many days during this and previous years to the subject, but it would appear to me probable that among the many useful purposes which the Institution serves, a thorough discussion of problems of this kind, particularly when they are approaching an immediate solution, is perhaps the most urgent of all its duties; and therefore I think, until the subject has been probed to the bottom, it is very desirable that the controversy should still proceed, whether in the printed pages of the Journal, or in this theatre. I am very pleased to see, having examined the question, *à priori*, from an altogether independent point of view, that my conclusions are almost exactly identical on the more important points with those which Lieutenant Benson from his fuller and riper experience has been able to form. There are, however, one or two matters on which I am entirely at issue with him. In the first place I imagine his view is, that the future "batteries" or "troops"

are to be divisional units, just like the three batteries of divisional artillery at the present moment. Of course there is a great deal to be said for that view, if it is only as a protest against the view advocated by Major Anderson and others, that machine-guns ought to be regarded as an integral part of a battalion of infantry, even to the extent of posting them to individual companies. I think the lecturer's suggestion a good one, but that it has gone too far. In the future organization of the new arm (for it is little less), I believe there are a Scylla and a Charybdis to avoid; and if the Scylla is the attaching of a separate machine-gun to each company, the Charybdis is surely the attaching of separate units to the Division. In my opinion the machine-gun ought to act with the *brigade of infantry*. I differ entirely from the last speaker in his view, as I understood it, that the use of machine-guns is more strictly that of an auxiliary to the cavalry than to any other arm of the Service. I believe that they are more suitable to infantry; and that the better plan would be to put a certain number of these "troops" or "batteries" under the immediate orders of the Brigadier commanding the infantry brigade. The immediate support of the infantry is the most urgent of all the wants of our present tactical system. The infantry is the arm of the Service which is told off to carry an enemy's position or to defend one of its own; and the more closely our new organization subordinates the action of the new weapon to the urgent necessity of supporting the infantry in both the attack and the defence, the more useful and striking result we shall get. I am a little bit at issue with the lecturer as to machine-guns in the new organization being employed *in addition to* the other arms. I agree with the last speaker that we do not sufficiently realize the limiting conditions which are binding upon us with regard to the suggestions that we have to make, one of the most rigid of those being that we are not to propose anything which involves any very large amount of expenditure without indicating such financial compensations as would result from its adoption. Now, if every Officer who has any important innovation to propose, were to endeavour to show how its adoption would lead to economy in other directions, and how by its means certain other arms of the Service might be reduced within certain limits we should obtain, I believe, more certain and practical results. If we employed a certain number of machine-gun batteries with brigades or Divisions, I think it would not be a very difficult matter to show that a certain portion of the other arms might safely be reduced, and to such an extent, I firmly believe, as to show a very distinct economy, combined with a marked increase of efficiency. Next, with regard to the weight of the gun, and the number of horses, I think the lecturer has made possibly this mistake. He starts with the assumption, which is no doubt correct, that the ten-barrelled Nordenfelt is a very much more efficient weapon than the three or five-barrelled, and therefore that our future machine-gun is to approximate in power and weight to this standard, with the consequent deduction that with the ten-barrelled Nordenfelt, four horses will be required to draw it. I think that in doing this he has conceded a very great advantage to the enemies of machine-guns, but if he could draw up an equipment which will only require one pair of horses to each weapon, the gain would be very great indeed, and would go a long way towards conciliating those who are opposed to its introduction. I believe such a design to be perfectly practicable. I think it is quite possible to have a very efficient weapon on a four-wheeled trail and limber carriage drawn by two horses, weighing between 16 and 17 cwt., inclusive of the weight of two or three gunners, and capable of being manœuvred at a gallop. If you can achieve that it seems to me that the gun, in a tactical point of view, will be nearly perfect. The target which a two-horse four-wheeled carriage would present to the enemy's fire would be very much smaller than that which would be presented by the four-horse carriage which the lecturer has advocated. I think we ought to make the *tactical desiderata* the real basis of our future organization. The weight of our guns must be the consideration which governs all others, and therefore, if the lecturer had commenced with the future tactics of the new arm, and worked out, *à priori*, from that stand-point a suitable weight and number of horses, he would have arrived at a result which would have given us a more certain efficiency, and would have commended itself more fully to the minds of this audience, while making no extravagant demand on the adaptive power of the inventors. I will just mention the results that I have

arrived at. I estimate that for a nine machine-gun battery we should require something like 75 to 80 horses and 130 men. That is very much more economical than the scheme drawn up by Lieutenant Benson for the same number of guns, which would employ something like 130 to 140 horses.

Lieutenant BENSON : It is seventy horses for a four-gun battery.

Major SMITH : Mine is a nine-gun battery, and requires from 75 to 80 horses and 130 men. With all that Lieutenant Benson has said as to the value of the arm, or with the greater part, I most cordially agree. He spoke about the enormous value which the machine-gun would have, if suddenly brought up at the critical moment, but I think he had rather in view that if the infantry suddenly failed or met some unforeseen emergency, the machine-guns would come up to its support. I go a step beyond that and think that, even when the infantry which is engaged in the attack of a position is not immediately assailed, when the supreme critical moment of the engagement takes place, when it is a question of moments whether the attacking or the defending infantry is to retire, that is the very time when, under cover of the smoke, machine-guns may gallop up, place themselves, if necessary, even in the midst of the shooting alignments and render most overwhelming moral and material aid. I trust that the paper will give the *coup de grace* to certain proposals which have been previously discussed in this theatre, one of those being the idea of affiliating the new arm to any one of the existing arms. I believe that to be the greatest of all errors, and for that reason I rather deprecate the lecturer's proposal that a machine-gun battery should temporarily, for experimental purposes, be assigned to the officers and men of one of the existing 9-pr. four-gun batteries of artillery. The officers and men of my own corps, very much as I value their military qualities, after all have regimental traditions of their own like others have, and even if their tactics are not influenced by traditions, I think the experiments would to a certain extent be discredited by the mere fact that artillerymen conducted them exclusively. The way to initiate the experiment with the new arm would, I submit, be to form an altogether new School of the arm at Aldershot or elsewhere, with representatives of every existing arm in the Service on its list, and provided with a certain number of weapons and horses, and then to let them work the thing out from a totally independent standpoint. Such a school would be a nucleus from which the future corps of machine-guns could be formed.

Captain STONE, R.A. : I have very few remarks to offer, but they will rather bear upon what the last speaker has said with regard to the mistake which has previously been made—of course, I speak under correction—of attempting to affiliate the machine-gun to any particular branch of the Service. I agree with Lieutenant Benson as to the objections against mounting machine-guns and ammunition on mules ; in fact, these objections have been already made sufficiently clear in the discussion which followed Major Anderson's paper. I think the system suggested by Captain Armit and others is equally open to objection, and I am sure that the idea of attaching them to the cavalry is opposed by many who have considered the question. I believe that the feeling at Aldershot, in the cavalry, is very much against the gun being attached to that branch of the Service. I cordially agree with Lieutenant Benson in his suggestion that machine-guns should be mounted on a light gun-carriage with a trail, in order to get the maximum mobility and steadiness, and I hope to strengthen his position by the remarks that I have to offer. Taking Lieutenant Benson's organization of a troop of four Nordenfolt guns with small-arm ammunition carts, we have fifty men and sixty-two horses—a somewhat large number. However, it will be sufficient for my purpose if I consider a single ten-barrelled Nordenfolt, mounted on a field-carriage carrying three men on the limber-boxes and 5,000 rounds of ammunition, and drawn by four horses, with a driver on each of the near horses, and one non-commissioned officer in charge (mounted), the gun being capable of delivering its fire at the rate of 1,000 rounds a minute. I hope to show that it would be far more economical to introduce troops of machine-guns, as Lieutenant Benson proposes, than even he imagines. The newest machine-gun, known as the Maxim Automatic gun, which has been so eagerly taken up on the Continent, and with which we are, I believe, experimenting, while other nations are arming themselves, is a one-barrelled gun weighing 50 lbs., in which the recoil of

the barrel does the whole of the work which is performed by hand in other machine-guns. It consequently requires only one man to manipulate it. The gun is mounted on a carriage with steel plate wheels and a vertical steel shield, the wheels being movable on a pivot, so that when in action they give, in conjunction with the shield, perfect cover to the man working the gun. The gun thus mounted can be wheeled along by two men, or, if attached to a limber containing 5,000 rounds of ammunition, can be manœuvred at a gallop by two horses with one driver on the near horse and two men on the limber-boxes. Then we come to the question of mobility, and, in order to have perfect mobility, that is to say, to be able to move at a gallop, you must have, so far as I can see, two horses, with the driver on the near horse, and to be able to manœuvre the gun just in the same way as with horse artillery. In working this out I find the following comparisons. A gun thus mounted, if attached to a limber containing 5,000 rounds of ammunition, which is the same amount given by Lieutenant Benson for his limber, can be manœuvred by two horses and one driver on the near horse, and two men on the limber-boxes. One of these men might be a non-commissioned officer; but that is a matter of detail. The gun only requiring one man to fire it, one man is really sufficient, but two men, a non-commissioned officer and a gunner, would be more than sufficient for all purposes. The gun fires from its one barrel 600 shots a minute, and can continue for any length of time without heating. We have, therefore, the following comparison:—With the Maxim gun, *i.e.*, without the ammunition cart (which will be the same in either case) the gun and limber, two horses, two gunners (one being a non-commissioned officer) and one driver, as against the Nordenfelt system which, according to Lieutenant Benson's propositions, has five horses, four men (including a non-commissioned officer), and two drivers.

Lieutenant BENSON: What is the total weight of the limber?

Captain STONE: I forget exactly. Curiously enough, I find that Mr. Maxim is sitting next to me, and he will be able to give you that. I have worked it out, and I find it is considerably less than two horses have been in the habit of drawing as their share of the weight in a field or horse artillery gun-carriage; so that I think I am justified in my conclusions. The amount of ammunition carried is the same, but the Nordenfelt fires 1,000 rounds in a minute from its ten barrels as against the 600 rounds from the one barrel of the Maxim. Now, without going into the entire personnel of a machine-gun troop, but taking only the strength of each subdivision—not taking the ammunition cart—and multiplying it by the number of subdivisions, let us compare a troop of six Maxims and a battery of four Nordenfelts. I find that for the Nordenfelt troop we have 20 horses, 16 men, 8 drivers, 4,000 rounds per minute, and 20,000 rounds carried on the limber. With the Maxim we should have 12 horses, 12 men, 6 drivers, 3,600 rounds per minute, and 30,000 rounds carried on the limber—a very much larger number of rounds carried; a difference only of 400 rounds that you have to deliver in a minute, which, I think, is unimportant, and a saving of very nearly half the horses—12 as against 20, 12 men as against 16, and 6 drivers as against 8. But perhaps the most important point of all is the very much larger amount of ammunition that would be carried with the smaller number of horses, owing, of course, to the very much greater lightness of the gun. I think this striking comparison of figures will much simplify Lieutenant Benson's scheme for organizing the machine-guns into troops as soon as we are in possession of a sufficient number of Maxim guns to make the experiment, as it appears to me that two of the principal difficulties which have confronted us hitherto can be swept aside, *viz.*, the apparently disproportionate amount of transport required for the results achieved, and the great cost of organizing such transport. There is one technical point which I should like to see settled, and that is the difficulty of getting the range by trial shots on certain natures of ground. In the Maxim gun this can be done approximately by a clever sighting invention; the sight consists of a pair of calipers so adjusted that when the object (say a man) is, so to speak, visually gripped, by lessening or increasing the interval between the calipers according as the range is less or greater, the elevation necessary for that range is given mechanically by an arrangement worked on a curve representing the trajectory of the gun, and set in motion by the screw which moves the calipers. So that the very fact of gripping your object gives the necessary elevation to the gun. With regard to the error, I

have worked that out most carefully, and, as Lieutenant Benson says, the most useful range for the machine-gun would be a sort of link between the artillery and the infantry; that is to say, between 1,000 and 1,500 yards. I find the error between the 1,000 and the 1,100 yards—a difference of 6 inches in the estimated height of the object—would only lead to an error of 20 yards in the range. At a range of from 1,400 to 1,500 yards an error of 7 inches in the estimated height of the object will give exactly the same error in the range—that is, 20 yards.

The CHAIRMAN: With regard to the calculation of weights which you have given, and which is rather important, do you derive it from a comparison with other carriages, or from what the horses can draw?

Captain STONE: It was derived from a comparison of the weight of the horse artillery and the light field artillery gun-carriage with limbers all ready for service, full of shell, with the men equipped in marching order, and drawn by six horses. I took one-third of that weight as being permissible for a pair of horses.

The CHAIRMAN: Did you take into consideration the necessity of the case that there are four wheels with a certain bulk of material necessary to enable it to withstand shock in going over ground? The method you have indicated seems to me so very likely to lead to disappointment in the end, that I mention it, because there are certain necessities of carriage which have to be considered.

Captain STONE: I have taken it as less than one-third of the weight of the ordinary Service carriage.¹ In conclusion, I may say I think Lieutenant Benson's suggestion to work the machine-guns as a separate arm is the first practical step in the solution of an obstinate problem, and, if not trespassing too much on his preserves, I would venture to add that the Officers should be specially selected from cavalry, artillery, and infantry, as well as from the Staff, in order that the varied requirements of the machine-gun troop may be intelligently met and its action in no way hampered by a too narrow appreciation of the tactical issues at stake.

Lord CHELMSFORD: Being the only military member belonging to the Council present, I should not like to allow this lecture and discussion to pass without saying a few words. I think that the Council has reason to congratulate itself upon the lecture which has been delivered to-day, and I am quite sure we all feel very much indebted to Lieutenant Benson for the very able manner in which he has dealt with this very important point. The way in which the advocate of the cavalry and the advocate of the infantry have both maintained that the weapon should be attached to their respective arms is, I think, a very strong argument in favour of Lieutenant Benson's idea that it should not be attached to either. I must say, speaking as a General Officer, that I think there would be a very great advantage in having this arm as a special unit attached either to a brigade or a Division, equipped and organized so as to be used to the best possible advantage, wherever the General Officer may think best. No doubt at times, I quite admit, the cavalry may require a weapon of this description, when it might do right good service. Lieutenant Benson forcibly points out the disadvantage of the weapon being attached permanently to any of the three arms, as except on particular occasions it would hamper instead of assist them. When not attached to any particular arm, the General Officer could keep these weapons in reserve, and would be able to use them in the

¹ On referring to the calculations which I made for the purpose of making the above comparisons, I find that I have really understated the case for the Maxim gun.

Taking the weight which six horses can draw, at a gallop, as 37 cwt. (weight behind team in 12-pr. gun), we have about 12 cwt. as the proportion for each pair of horses.

Weight of Maxim gun and carriage	..	1½ cwt.	} These weights are approximate.
1,336 cartridges in four boxes on gun-carriage	..	1½ "	
Weight of limber	..	1½ "	
4,008 cartridges in 12 boxes on limber	..	4½ "	

Giving a total of 5,344 rounds, and a weight behind the horses of 9 cwt. or three-fourths of the share of work which falls to each pair of horses in a gun-team. I think the margin is sufficient to meet the Chairman's interpolation. The wheels are of hickory; the axle and trail of tubular steel.

manner best suited to assist his general plan of operations. Lieutenant Benson has been obliged to use the word "Nordenfelt gun," because it is the one which he himself has seen in work. I trust that this will not lead to a discussion upon the relative merits of these guns. We are met here to discuss the broad question as to their organization and their use in the field, and it would be, I think, very injurious to the interests of the discussion if we were to diverge into the relative merits of machine-guns. There is one point which it is decidedly right should be discussed, and that is whether a heavy machine-gun has an advantage over a light one, and also with regard to its equipment. I think myself that Lieutenant Benson makes out a strong case for the heavy gun, because it can be taken at speed over much rougher ground than the lighter one, with less risk of being upset, and with less chance of injury to the weapon itself. With regard to the organization, I contend that it ought to be a separate unit. Of course, as one of the speakers has already remarked, there is the question of expense, but let us argue the matter merely from the abstract point of view, and let us believe that the War Office will be sufficiently patriotic to give us the best possible organization, provided we can prove that it really is the most efficient. Then with regard to the tactics, I do not think there is any necessity to discuss the use of the machine-gun in the defence of a position or of a fortified post. That is perfectly well established. But with regard to attack and how machine-guns are to be used, no doubt very important points are raised. The infantry now-a-days, with far-reaching and precise rifles opposed to them, have a very difficult task indeed when they have to advance and attack a position, and any assistance they might receive during that advance would no doubt be of enormous value. I do not see any reason why that assistance should not be given by machine-guns, although they are not attached absolutely to the infantry, quite as, if not more effectively than, by the artillery. The artillery take up a position at a considerable range, and having obtained that range are able to pour their fire into the enemy's line, and the machine-gun can be employed in the same way. But there is one important advantage which the machine-guns have over the artillery at one particular period of the attack, which has not been touched upon by the lecturer. When the infantry get within about 800 yards of the enemy's line, the artillery cannot assist them any longer without firing over their heads. Now I believe it has been perfectly well established by all writers on tactics that there is nothing that shakes infantry more than the fact that their own artillery are firing over their heads. It is a very disagreeable sensation; fuzes will not always burst the shell at the right moment, and any shell coming amongst infantry from their own side does more to shake their steadiness at the critical moment than any fire from the enemy. That disadvantage, however, does not apply to machine-guns. Supposing you can place your machine-guns in position at 1,200 yards from the enemy, having a good command, the bullets that go over the heads of your attacking infantry would not be distinguished from those coming from the enemy's side, and therefore the infantry would get efficient support without any disturbing influences. In such a case I think the machine-guns could give infantry most important support at a time when artillery would be quite unable to do so, without perhaps doing more harm than good. I would venture, in conclusion, to say that I believe artillery in position might often receive very effective assistance from machine-guns. Artillery have often to take up exposed positions to protect the flank of infantry advancing to the attack; they are consequently often exposed to attack from cavalry, or even from infantry. Machine-guns, temporarily attached to batteries so employed, might enable them to remain in action, and prevent them from being severely handled by a counter-attack. Such service would be certainly very much appreciated by that arm, and would add much to its efficiency.

Mr. MAXIM: I fully agree with the author in what he has said about the difficulty of accurate firing of machine-guns from "galloping carriages." You can make moderately good shooting from the back of a horse, provided the rifle is perfectly free, but if the rifle and the horse were fairly secured together, and the relative position of rifle to horse were regulated by screws and gearing, it would be exceedingly difficult to make good shooting. So with a gun mounted on a platform, one end supported by wheels and the other by a frantic horse, I can conceive it

would be an exceedingly difficult matter for a man to shoot well with the gun firmly screwed down to its platform as it must be if it is operated by hand. If a gun is operated by hand it necessarily requires some considerable force to operate it; it, therefore, cannot be free to turn in every direction, as it would participate in the action of the handle. It has to be screwed down to something and aimed with gearing; in order for the gun to be pointed screws must be turned, and it would, therefore, be exceedingly hard to do any kind of shooting from a platform which is constantly moving, the relation between the platform and the gun having to be constantly changed to counteract the movements of the horse. The machine-gun which I have made, and which has had many competitive trials, weighs but 50 lbs., and does not even require screws or training-gear. Some speakers have referred to the necessity of a heavy mounting. I may say that the automatic gun being self-contained, requiring no external power to operate it, has very little tendency to move while firing. A man can lie down on the ground and fire it in the same manner that he can fire a rifle. He can have a box containing several hundred rounds of ammunition beside the gun, and by once pulling the trigger he can fire the entire box without any mounting at all. There being only one barrel there can be but one shot fired at the same time; the strain is, therefore, very light, and a very light carriage can be used, and absolutely without training-gear, except you wish to fire at a target at a long range. I find that the gun being light and requiring an exceedingly light mounting, I can afford to use a shield, the weight of the shield attached above the gun being about 60 lbs. My two shields combined weigh less than 100 lbs., and this carriage with both shields weighs no more than 200 lbs., so that one is able to carry into action 1,300 rounds of cartridges attached to the carriage itself. I find that the weight of the cartridges and the shields steadies the gun and enables one to do most extraordinary shooting. For example, in France the weight of the cartridges and shield together so steadied the gun that 80 per cent. of the shots went into a target 2 feet square at 800 metres, and the French Officers said at the time they were unable to account for the extraordinary accuracy of fire. If any of you would like to see this exceedingly light carriage I would say that I believe both it and the gun are on the premises.

Lieutenant-Colonel ALT: The paper we have heard read is, I consider, an excellent and exhaustive one; but I cannot concur in the conclusions the lecturer arrives at. Being an artillery Officer he naturally thinks on horseback, and considers that machine-guns are not capable of being worked with advantage by infantry, but should be mounted on horse carriages organized in troops of four guns each, and be attached to each division of an army corps. He gives his reasons against their use by infantry under three heads, to which I propose briefly to reply. With regard to the enormous labour of dragging these guns in a campaign, I can only point to what the men of my own battalion have done regularly with the Easter marching column, and at the Aldershot drills, for several years past. The 5-barrel Nordenfelt guns mounted on our magazine carriage have been dragged from Petersfield to Portsmouth, from Canterbury to Dover, from East Grinstead to Brighton, from Aldershot to Pirbright, and back on a bee-line across the Fox Hills, and the Long Valley, with its ruts and dust, is as familiar to our gun detachments as Oxford Street to a London cab-driver; no high-roads, bye-roads, country paths, hills, or downs encountered on the way, have checked their march. Our men never complain, except at the indignity of it being proposed to relieve them, and only accept assistance when breasting a slippery slope, impracticable for artillery, or a steep incline on a heavy or newly-metalled country road. Any loss of distance under such circumstances is more than picked up at the double on the down grade, and by the time the battalion is in attack formation the guns are always in position to take part in the fighting line. If we can do this in the Volunteer Service, Tommy Atkins is not the man I take him to be if he mutinies against being called upon for similar work in the regular Service. With regard to ammunition, our magazine carries 5,000 rounds, and each man of the gun detachment 100 rounds, making 6,000 rounds available for each gun the moment it comes into action. The replenishment of this supply in action is a simple matter of detail. With regard to hand draught giving the least possible mobility, I have already shown that our guns keep up with the battalion under all circumstances, which is all that should be required of

them ; but if additional proof were wanting of their mobility, I may mention that one of the guns, with the usual detachment, has occupied a bridge two miles to its front, and come into action in nineteen minutes ; and for getting across difficult country for a similar distance, I would like to back one of my hand-drawn carriages against one of Lieutenant Benson's horsed wagons with limber. What I mean is going straight across country by-paths, fields, over banks, ditches, hedges, anything that came in the way. I claim for the hand-drawn gun all the advantages of machine-guns so ably pointed out by the lecturer, with the additional advantage that they form a much smaller and more difficult to be distinguished mark for the enemy's artillery and infantry than any other system ; it being very hard to distinguish them at any distance, on certain grounds and in the smoke of action, from a cluster of skirmishers. With two guns attached to each battalion a Brigadier or Divisional General could mass his machine-guns if occasion called for it. I do not think that my battalion is weakened by the detailing of the necessary detachments to work the guns, but that confidence is rather imparted to it by having its flanks covered by those weapons, and by the general feeling of security their presence imparts to the rest of the line ; and I do not find they get any more out of my control in practice than the companies of a battalion in extended order or detached for outpost work. I should be pleased to see machine-guns attached to each branch of the Service, but I contend that as they are but clusters of rifles their proper place is with the infantry. I contend also that they should be mounted upon a single magazine-carriage to be drawn by hand without being encumbered with shafts or separate limbers, which are impediments which I found to interfere altogether with the effective working of the guns, and which might with reason be complained of by Tommy Atkins, if he were given machinery of that sort to manipulate. It appears to be the general feeling of the meeting that these guns should be horsed and worked in batteries. And with reference to Lord Chelmsford's remarks as to the firing of machine-guns over the heads of infantry not resulting, as with artillery, in shells sometimes dropping upon your own men, I may suggest that there are such things as defective cartridges, which sometimes fall short, as I have found to be the case with field-firing experiments at Aldershot, and it would be just as startling to men advancing across country to find a few bullets coming into their rear as it would be to have shell bursting short over their heads. I was glad to hear Major Smith admit that these mounted guns might gallop up at a given moment and take part in the fighting line, but it appears to me that if I can sneak up my machine-guns with the fighting line my non-commissioned officers or Subalterns attached to them can judge much better as to the best position to be occupied than one of these flying batteries, dashing up in the heat of action to take up a position ; and I think my guns would be much better able to produce the effect which it is desired to demonstrate could be obtained by the flying battery. Time prevents my touching upon statistics with regard to weights, number of men and horses, &c., and I therefore conclude by tendering my personal thanks to the lecturer for his valuable contribution to the subject of machine-guns.

The CHAIRMAN : Do I rightly understand you to advocate machine-guns being galloped up ?

Lieutenant-Colonel ALT : No ; I say I can get across an ordinary enclosed country on a bee-line as fast, for a mile or a couple of miles, as a horsed battery of machine-guns would be able to do by having to keep to road or clear away banks and ditches to get through.

The CHAIRMAN : I only interpolated because I thought you spoke with approval of what Major Smith said as to their being galloped up in front.

Lieutenant-Colonel ALT : It has been objected to machine-guns that they could not take part in the fighting line, but I have always so worked my guns when necessary, both at Easter reviews and on field-days at Aldershot. I do not consider they would be likely to suffer more in that way than the individual men would be which formed the fighting line.

Mr. C. FREDERICK LOWE : At the lecture given on this subject in January of last year, when Lord Charles Beresford was in the chair, I called attention to the fact that General Gordon, in his diary written at Khartoum, in December, 1884, a few days before his death, said, " Against a good mitrailleuse, and a sharp operator

with a good telescopic sight, no gun could be served with impunity at 2,000 yards range, although it could be served against artillery fire, for at that range there is plenty of time to dodge under cover after seeing the flash ere the shell arrives." Now I am in a position to say that this very practical suggestion of General Gordon is fully endorsed by a distinguished and gallant Officer occupying a very high position, and it would be interesting to learn whether the makers of machine-guns have taken any practical measures to carry out this idea. Of course the theory formed by General Gordon as to the effect of these telescopic sights was founded on the experience of the American Civil War. Since the date of that lecture I have been favoured by letters from Officers and soldiers who took part in that war with telescope rifles which were manufactured in this country, and ran the blockade. The other day I got a letter from a Colonel in the Confederate Army, in which he said that when General Longstreet's corps was approaching Suffolk, in Virginia, in the early part of 1863, by one of the level roads leading to that place, the advance of the corps was discovered by a Federal signaller, perched on a barrel erected on the top of a high pole, like the crow's nest used by the Arctic voyagers, and who was seen signalling the Confederate movements to the Federal troops in his rear. Several of the sharpshooters of Longstreet's corps were armed with Whitworth telescope-sighted rifles, and one of them being called to the front was told to try a shot at the occupant of the crow's nest. This he did, and the man immediately disappeared below the edge of the barrel, and no more signals were given by him. In the advance then made the Federal skirmishers were driven back beyond the crow's nest, which was found to contain the dead body of a soldier shot through the upper part of the body. The great distance at which he had been killed induced General Longstreet to have it measured, when it was found to have been 1,300 yards. I have other letters from other Officers in the Confederate service, and also from one of the men who carried one of these rifles through the whole war, giving similar details, and on the other hand there is a letter from an Officer in the Federal service.

The CHAIRMAN: I think this is rather wide of the mark.

Mr. LOWE: Then I will venture to draw attention to the fact that the sights of rifles, machine-guns, and cannon are all alike. I venture to say that the sights of all the present firearms in use are very defective. I was told by a gentleman whose business it is to make and sell machine-guns, that he once shot—

The CHAIRMAN: I am afraid it is not relevant; there are many gentlemen anxious to speak, and our time is extremely short. We have had ample evidence that the desire of the meeting is that the discussion should be directed to the question of machine-guns.

Mr. LOWE: May I suggest the application of the principle of the aperture sight to machine-guns?

The CHAIRMAN: No. What we have to deal with is the general question.

Colonel TALBOT COKE: I wish to say one or two words with regard to what the lecturer has said, namely, that it is during the time of peace that we should make experiments for war. During the two years that the battalion under my command has been at Aldershot, we have fully tested the machine-guns, both on ordinary field-days and in the usual peace manoeuvres. The first gun we had was mounted on pack mules, and I quite agree with what has been said, that it was useless when so carried. This year we have the sailor's carriage (such as is used by the Naval Brigade), drawn by one mule, and that carriage is also very faulty. I firmly believe that there is only one class of carriage that will ever really meet our military requirements, and that is the limber with the trail. I will not enter into the subject of weight, but I think it is a mistake to go from one mule to four horses. One mule has hitherto done our work with ammunition and gun on one carriage, and to jump from that to four horses is rather too long a step to be taken all at once. I should like to see the infantry gun with a limber and two horses. As to the concentration of guns in the field, I think that might be carried out by the Brigadiers, even if the guns are with the various infantry battalions, and I quite agree with the lecturer, that for practical purposes they should be concentrated in the field.

• Captain WALTER H. JAMES, late R.E.: Having some years ago advocated the

question of a carriage from which the machine-gun could be fired without unlimbering, I would ask permission to say one or two words on that subject. I am perfectly prepared to admit that the idea of a gun firing while retiring is somewhat of a Utopian character, but if you concede that the machine-gun is chiefly a horse artillery weapon, I think there are moments in the collision of hostile cavalry when a machine-gun which can be fired, even though the horse do disturb its aim somewhat, will be of the greatest utility. The only other point to which I would like to draw attention is one which has not yet been alluded to by the lecturer, and that is the position that the machine-gun occupies at the present moment, when a small-bore rifle is about to be introduced. The great object sought to be gained by using a cartridge of the same bore as the rifle was that it prevented the introduction of another kind of ammunition in the field, with all its attendant disadvantages. Granted, but when you come to this, that in a very short space of time you will find your infantry armed with a weapon, if I may judge from a recent General Order, of 0.298 calibre, it will be a very grave question whether for your machine-guns you will retain the same cartridge, or whether you will not be able to get a much more efficient weapon by introducing a different kind of machine-gun altogether. When the French introduced their mitrailleuse they used a much heavier cartridge than that for the rifle, and I do not know that there is any instance in the record of the 1870-71 War of failure of the ammunition supply. Therefore it may be conceded that it is possible to supply your mitrailleuse with whatever cartridge you determine shall be employed in it. This being the case, we have to consider what will be the best cartridge to give the machine-gun in the future. One difficulty with the machine-gun is undoubtedly range-finding, but Lieutenant Benson proposes to attach a gun which shall be used for no other purpose than range-finding.

Lieutenant BENSON: And to be carried on the limber.

Captain JAMES: I will go further. I would propose the introduction of a weapon which can be used for range-finding and for fighting purposes in addition. We are all of us aware of the great stride made in rapid-firing guns of late, and it seems to me that the future best form of mitrailleuse will be something of this kind; firing a shell which shall exceed the Geneva Convention weight, *i.e.*, over 1 lb., probably 2 lbs. or 3 lbs., which shall contain a high explosive fired with smokeless powder, with a muzzle velocity of 2,000 feet. You would obtain a very different effect from a battery of these weapons to what could be got from a battery of rifle-calibre mitrailleuses; they would not only possess man-killing power, but also battering power, because even the small charge, of say gun-cotton, contained in those shells, which would probably be of steel, would have a fairly efficient battering character.

The CHAIRMAN: Would they explode on impact?

Captain JAMES: Yes, of course, with percussion fuzes. I have come to this conclusion, therefore, that the new rifle cartridge is not adapted to the machine-gun, because it is so very difficult to find out what it is doing; that the advantages to be obtained from machine-guns can be very much better obtained from a quick-firing than from an ordinary machine-gun as accepted at the present moment; and then I come to the point as to how these batteries are to be organized. I am distinctly of opinion that the cobbler should stick to his last. If you attach the machine-gun to infantry or to cavalry, or to anybody but themselves, I think they will always occupy a secondary position. I am convinced that you ought to organize your machine-guns in special batteries. Various propositions have been made of this kind. Some years ago a gentleman was good enough to suggest that they should be attached to the branch of the Service to which I belong; but I do not think that is a practical suggestion. I think they should be organized in batteries, such as have been suggested by Lieutenant Benson, or as was suggested in this theatre a great many years ago, just after a Committee enquired into the use of machine-guns in the field. What should these batteries be attached to? I think they should form special reserves under the Divisional Commander. I should be almost inclined to go even higher in European warfare, and say the corps Commander; that a corps Commander, taking our present Army Corps, should have perhaps twelve of these rapid-firing guns attached as one battery, and in addition

to that I think it should form the main weapon of the horse artillery attached to the cavalry. It would take too long for me to go into the special tactical uses of these guns; a heavy, rapid, and continuous fire from such a battery as I suggest would, I think, be much more efficacious than that from any mitrailleuse merely firing the infantry bullet of the future.

Mr. NORDENFELT: I wish to be allowed to protest in a gentle way against one remark of Lieutenant Benson's, viz., the last remark he made about the firing at Aldershot. It is quite true that on one particular day the guns did not hit well, although on the previous days they had done very well. Major Mechem, the Musketry Instructor at Aldershot, and the Officers of the regiment, had trained the men very perfectly with dummy cartridges, but before that trial I believe they had not fired any ball cartridges, except a small number on one day previously. It is necessary for men to be trained for machine-guns almost as much as for rifles, and I do not believe that any man who has only fired 300 rounds can suddenly set to work and hit targets at long ranges, indeed Lieutenant Benson admits that himself. The infantry carriage and the cavalry carriage have been made with a view to mobility. When Lord Charles Beresford came back from Alexandria, he told me that he did not see why we could not arrange guns to act like torpedo-boats ashore, and it was entirely due to Lord Charles Beresford that I commenced to push forward these galloping carriages. Since then Colonel Liddell, Major Wilson, and Captain Baden-Powell have been working for months with these carriages, and have gained a great deal of experience. At Aldershot the results of target firing have been sometimes good, and sometimes bad. Amusingly enough, some of my own men went down the other day, and fired very badly; in their great anxiety to fire quickly, they did not hit at all, whereas the disciplined men trained by the three infantry regiments made uncommonly good practice, in some instances at 400 yards making from 80 to 90 per cent. of hits. Although it is not for me to decide in what manner the guns should be employed, I hold with the lecturer that the mule can only be used in mountain warfare, but for this purpose I fully believe that the mule will be used, because there are many occasions when a light gun in mountain service will be found to be exceedingly useful; but it will have to be on a separate mounting, in the same way as in the case of other guns for mountain service. Next, as to the infantry and cavalry, whether the gun is to be used as part of a regiment, or as a tactical unit of a brigade or a Division, I do not pretend to understand; but guns actually following the regiments or brigades on certain opportunities must be exceedingly useful, and must come into the armies. The guns will have in some way to be attached and organized so that the Colonel and the Brigadier-Commander who needs them will not have to send a messenger half a mile to the Divisional General to ask for them, because then they may never find one another again. The gun must be exceedingly handy; the opportunities given for its use may not last more than a minute or two, and if it takes five minutes to go and ask for the guns they may lose their chance, which might have been invaluable. That is the point on which I strongly urge the value of mobility. Mobility is a relative term. With an infantry regiment it means the speed with which the infantry can move at the double; with cavalry or artillery it means the speed at which they can go; therefore, I believe that the galloping carriage, with perhaps alterations such as have been described, or some other carriage, must be used for the machine-gun. Lieutenant Benson has misunderstood one point. He says the horses are not taken out. The idea is that the horses should be taken out at longish ranges, when you are not under immediate and close fire, but that the horses should be left in the shafts at short ranges, when you suddenly come upon your enemy at anything between 200 and 800 yards. For that purpose, when your target is not a small target but a large one, I believe it will be found on extended practice that the movements of the horses do not seriously affect the gun. I say this distinctly, because if you take a target representing a squadron of cavalry, it will be about 3 feet high by 50 feet wide, and that target will be hit by a very large percentage of shots fired at these ranges, whereas if you fire at the Wimbledon target with a bullseye, you may not hit it with any large percentage of the bullets fired. The machine-gun is intended to fire a rain of bullets falling for a short time, but the moment you begin to calculate mean deflections measured in inches, you may not have good targets. If you keep before your

mind that the machine-gun is not meant for that purpose, except possibly firing at a General and his staff at long range, you will never use it for accurate firing, but simply in order to throw a sudden and unexpected rain of bullets on your enemy, he not knowing where on earth they come from. Captain James spoke about the small-bore cartridge. This cartridge can only affect the machine-gun in the same way as the rifle. If the cartridge is only two-thirds of the weight, that means that you can carry 50 per cent. more ammunition within the same weight. As to quick-firing guns moving rapidly, I am entirely of Captain James's opinion, but it has nothing to do with rifle-calibre machine-guns at all. Machine-guns are separate things firing rifle cartridges, and I am certain that the machine-gun must be adopted into the Service in connection with cavalry and infantry. I do not care whether it is a separate tactical unit or attached to regiments, but if clever gunners like Lieutenant Benson can possibly work up an interest in favour of having heavy guns with artillery mounting, I for one shall have no objection, but I have not very great hopes of it. On the other hand, I fully believe in the 6- or 8-pr. Shrapnel guns which I am making. Those guns, I believe, will and must go wherever light artillery goes, but heavy field artillery cannot move quickly enough, and cannot advance so close to an enemy as these quick-firing guns protected by their shields are able to do.

Major-General ARBUTHNOT: I have had a great deal to do with experimental guns, and all the machine-guns in the Service have passed through my hands. Perhaps, therefore, I may be allowed to say a few words. I am not going to touch so much upon the question of tactics as on that of equipment, but I think that there ought to be two separate equipments, one for cavalry and one for infantry. With regard to whether the gun should be attached to a regiment of infantry or cavalry, or whether it should form an independent unit, is I think a matter of minor importance, provided you have a separate equipment for the two arms with which it is to be used. The galloper carriage first introduced two years ago was got up on Lord Charles Beresford's suggestion, and has been worked out since by Colonel Liddell, Mr. Nordenfelt, and myself, and I believe the last carriages which have been issued have given general satisfaction to the 10th Hussars, which regiment has carried through all the experimental work. Although one of the regiments at Aldershot made three hits out of seven rounds, the 10th Hussars certainly made much better practice than that. I have seen them practising with the guns on the galloper carriages with the horses in the shafts, and they certainly made many more hits than three out of seven, or whatever it was. I think if the horses are trained and the men are trained and understand the working of the guns, with the aid of the prop which has been introduced by Mr. Nordenfelt, very steady firing can be obtained, even without taking the horses out.

The CHAIRMAN: At what kind of target and at what range?

General ARBUTHNOT: At ranges below 600 yards and the horses left in; beyond 600 yards the horses may be taken out, and then the fire will be just as steady as on any other kind of carriage on which the gun might be mounted. There is one great advantage in the two-wheeled carriage for cavalry, namely, that it can be brought into action pretty quickly, whereas if you have a limber, and you have to unlimber your gun before you go into action, you cannot fire half so rapidly as if you carried the ammunition with the gun itself. With regard to the infantry mounting, there are two equipments for infantry, one being with mules, which is intended for mountainous countries. It is never intended that the mule equipment shall be for the ordinary service of the machine-gun working with infantry, but just as you have two equipments for artillery, the mountain equipment and the general equipment, so with the machine-gun. Therefore, to say it is useless is only to say it is useless if you are in a country where a superior carriage can move, but it will not be useless in a hilly country where you cannot use the ordinary carriage. The mule equipment of the machine-gun is a very good one for the purpose for which it is intended, namely, for use in mountainous countries. With regard to the two-wheeled equipment of machine-guns to be used in conjunction with infantry, the mounting is based on the same lines as the landing carriage for the Navy. That landing carriage for the Navy was got up after the campaign in the Soudan. The Naval Brigade there had a Gatling equipment converted to take the Gardner gun

with a limber, but it was found so heavy and so inconvenient, and in every way so objectionable, that Captain Wilson, R.N., who had the working of these guns in the Soudan, wrote a report on the subject, in which report he advocated the adoption of a two-wheeled in preference to a limber carriage. A Committee was formed, of which Captain Wilson was a member, and which recommended the two-wheeled landing carriage which was subsequently adopted, and which I believe gives general satisfaction in the Navy; it has entirely overcome the objection which was found with regard to the use of the limber carriage. When it was desired to get up an equipment for the infantry the naval landing carriage was taken as the line on which to build the infantry carriage, in consequence of its having proved so successful. I am speaking under the correction of Mr. Nordenfelt, but I believe the landing carriage which was used for the infantry as far as regards the mounting was on the same lines as the landing carriage for the Navy.

MR. NORDENFELT: Entirely.

General ARBUTHNOT: That carriage was two-wheeled; two horses can be put in it if necessary, a man riding on the near horse. That is considered preferable to having one horse and leading it. There is no objection to a man riding and driving the carriage. The gun can be fired with perfect steadiness. The horse can be either taken out, or the gun can be fired with perfect steadiness by propping up the shaft if the horse is left in. I have seen most excellent practices made with a gun mounted on a carriage of that sort, and considering that it can carry 2,000 rounds of ammunition that gives it an immense advantage over the limber carriage, which should not be forgotten. With regard to the weight of the gun, I think no gun issued to infantry or cavalry should exceed 100 lbs. in weight at the very outside; anything beyond that to my mind necessitates a very much heavier carriage and wants more strength. A gun under that weight could be carried on a comparatively light carriage, because there is not the same wear and tear as with a heavier gun. Another advantage is that it carries very much more ammunition for the same weight. I do not agree with Captain James, that the small-bore cartridge is unsuitable for the machine-guns. I think if a cartridge is efficient out of a rifle it is equally efficient out of a machine-gun, and to my mind the great advantage of the machine-gun acting with cavalry and infantry is that it should fire the same ammunition as rifles, because then every reserve of ammunition would supply both machine-guns and the rifles.

Captain JAMES: May I be allowed to explain? I do not deny the use of the new cartridge with a machine-gun, but I believe you will get a very much better effect, quite worth all the additional complication of ammunition, out of my proposal.

General ARBUTHNOT: That is a point I should hardly touch on to-night. The question of the ammunition of machine-guns is somewhat departing from the subject of this discussion; I think, however, being able to carry more ammunition is another advantage of having the light cartridge. If the gun is, say, 90 lbs. in weight, you can carry 2,500 rounds of ammunition without its being too much for one pair of horses, and you can have a carriage strong enough to carry that weight of ammunition with a light gun. I think the 10-barrelled Nordenfelt is altogether out of the question for field work. If you go into that great weight of gun, you may at once have field artillery, it is altogether beyond the question of musketry, it is too heavy a gun for field purposes. There is one point that has not been touched upon, and that is with regard to the uses of machine-guns. I think it will be found in warfare that they are more useful for defensive purposes than for offensive. For defending a bridge, or a defile, or for street firing, the machine-gun will, I think, be invaluable. You can by its means fire a rain of bullets concentrated on one spot, down a narrow lane, which no number of men could ever attempt to compete with. I think myself, a large number of guns of a few barrels each would be more efficient than one gun with several barrels, because the fire can be spread over a larger surface. You cannot kill a man more than once, and if you fire your 10-barrelled Nordenfelt, ten bullets may hit one man, which is not the service that is wanted. What is wanted is to spread the fire over as large a surface as possible with a few barrels. I will not detain you longer.

Lieutenant-Colonel J. P. BRABAZON, 10th Royal Hussars: Sir, I rise to make a few observations on this important subject, and do so with the greatest diffidence,

as, unlike most of the speakers whom we have heard this afternoon, I have not had the advantage of reading or knowing the contents of the very able paper by Lieutenant Benson, until it was read to us by him a few minutes ago. When I entered this hall I had no intention (as I was utterly unprepared) of taking part in the discussion, but with your permission I should like to make a few remarks on what I have heard fall from the speakers who have preceded me. As to the description of machine-gun, and its various scientific technicalities, I leave to cleverer men than myself to determine, but for cavalry it is absolutely necessary that it should be of a light and handy description. That attached to my regiment, and horsed with two horses, has in my opinion proved itself a very light, handy, and suitable weapon. But one detail I think common-sense points out to us to be absolutely necessary to its utility, and that is that it should be of the same calibre, and carry the same cartridge as used by our infantry. Lord Chelmsford, in his remarks, said that the great anxiety shown by both infantry and cavalry to have this machine-gun attached to them was a reason, in his opinion, that neither should have it. I beg to differ most entirely with his lordship. English soldiers are very conservative and look with distrust on any change of armament and equipment, and the very fact that these two branches of the Service are so anxious to get it is, in my opinion, a strong reason not that neither should have it, but that both should. When I mentioned two arms of the Service I ought to have included the third, for artillerymen seem as anxious to have it as an adjunct, as do the infantry and cavalry. I have heard during this discussion the machine-gun frequently alluded to as a "gun" and talked of as being in "battery." I protest against this. It is not a gun in the popular military acceptance of the term. It is a "rifle," *pur et simple*, a machine rifle, and a rifle that in my opinion ought to be permanently attached to every cavalry regiment, whatever its best position may be for the other branches. Mr. Benson I believe favours, and Lord Chelmsford supported the idea, that these machine-rifles should always be attached to the artillery, and in action some of them placed under the immediate command of Brigadiers and Generals of Division, to be sent for when wanted; this would in my opinion never answer, especially as far as cavalry is concerned. It is essentially a weapon of "opportunity," to be used on the spur of the moment, and if that chance is allowed to slip by, the whole *raison d'être* of the gun disappears. Napoleon, when he advanced on the Danube in 1805, had his cavalry from 80 to 100 miles ahead of his main body. In the Franco-Prussian War, the German cavalry, whenever possible, was from 20 to 30 miles ahead of the infantry. The rôle of cavalry is to be as far as possible in advance, and act as a screen to the main body. Imagine cavalry not 80 or 100 miles, nor even 20 or 30 miles ahead, but say only 4 or 5 miles ahead, and suddenly finding a splendid opportunity for using these guns, and having to send back miles to get them, it is a thousand to one the opportunity when they might have been of the utmost utility would have fled long before they could come up. I am surprised, from an extract read out of a letter from Colonel Ward Bennitt, to find so distinguished a cavalry soldier an opponent to having this weapon attached to his regiment. I cannot conceive a cavalry soldier not receiving it with open arms, for I foresee that their introduction as part of cavalry armament will be of immense service, and tend to keep the cavalry soldier where a cavalry soldier ought to be, viz., in his saddle. Englishmen understand the horse better than any other European nation, I think I may say better than any other nation in the world. We breed the best horses, our men ride better, are better dressed, and better equipped. We have everything in our favour to make our cavalry, if small in number, the most splendid body of horsemen in the world, and we throw all these advantages to the winds and worry ourselves with trying to turn what ought to be, and could be, the most magnificent cavalry into indifferent infantry; just as on the same principle we are turning our best infantry into execrable cavalry under the name of "mounted infantry." It is lamentable to me to see the rôle of cavalry so completely misunderstood, and I know nothing more ridiculous and heartbreaking than the sight of a dismounted dragoon, encumbered with sword, sabretache, and spurs, carbine in hand, dodging about bushes like a rabbit. I foresee that these guns may possibly save us from all this, and once more put our splendid cavalry in its proper place. But then some people are very narrow-minded about changes of any sort, and I am afraid lancers are

ultra-conservative about their armament, for I remember there was just as strenuous an opposition on their part to the introduction of carbines as there now appears to be to the machine-guns. I remember, at the time I allude to, an Officer of lancers who was about to exchange into a hussar regiment telling me that his old troop sergeant-major asked him if the report he heard of his intended exchange was true; on being told it was, said sadly: "Well, Sir, of course you know best, but personally I shouldn't like to be found drowned in the same parish with a carbine regiment." Evidently he feared that his friends might think he had passed his last hours on this earth in the disreputable company of anyone who could use a carbine as a weapon of offence or defence, and apparently the old conservative sergeant-major is not singular, and there are some of the opinion that any regiment who can advance the utility of the machine-gun must be as utterly disreputable as the carbine regiment referred to by the old lancer. Referring to the Germans, the most practical and scientific soldiers of the day, and their estimate of the machine-gun, I may remind you that they were opposed in 1870 and 1871 to an enemy that had machine-guns (*mitrailleuses*) attached to their infantry, but they apparently did so little damage and were so little thought of by the Germans, that though seventeen years elapsed since that war, I have never heard of their adopting machine-guns as adjuncts to their infantry battalions or artillery batteries. Last summer, however, Prince William of Prussia, accompanied by some of the most distinguished cavalry Officers of the German Army, who were over here for the Jubilee rejoicing, did my regiment the honour of paying us a visit at Hounslow, and were so impressed with our two-horse Nordenfolt gun, its handiness and applicability to cavalry movements, and the ease with which it kept up and manœuvred with us during a galloping field-day, that Prince William immediately ordered a facsimile gun to be sent over to Germany, and we sent over one of our men to Potsdam, to show them how to work it; and so taken by it are they, that I believe I am right in saying that it is going to be adopted for their cavalry. Lord Charles Beresford is anxious for me to repeat what I told him a few minutes ago as to the confidence it inspired and the popularity of this gun among the men of my regiment. I was much surprised to hear from one of the gentlemen who preceded me that he found the consensus of opinion among cavalry Officers at Aldershot to be adverse to this gun, and that it was unpopular with soldiers; all I can say is that such is not the case in my regiment, where the gun is very popular, as I confidently believe it will in time become with the remainder of our Army. Great stress has been laid by those whom I may call the opponents to the gun on the danger of its being put out of action through horses being shot, or from being upset going over rough ground. There seems to be much misapprehension about the way these guns are to be used. On only the rarest occasions have I seen them fired with horses attached, and then never against infantry. But there may arise occasions, when you want to get a few rounds in against cavalry advancing in close formation, when it would be necessary to use them with the horses attached, so that they may continue firing till the very last second and then gallop away out of action or under cover of their own cavalry. As regards the horses being shot, that is of course an accident that equally obtains with artillery, and a gun with its lead horses shot is equally out of action until they are replaced by others. In every troop there are five or six horses trained to harness, and if one or even both horses were shot they could be easily and speedily replaced. As regards their upsetting, they can go anywhere where cavalry can go. I have seen our gun worked over the Fox Hills (which I think everyone will allow is bad ground for cavalry; at all events, I have never seen a field-day there without both men and horses going head over heels, through galloping into the heather-hidden holes and ruts), and yet the gun working at a gallop has never come to grief. But suppose it did. Suppose all the horses trained to harness were shot. Suppose the gun went head over heels, and was so damaged as to become useless. It would be bad luck, but not an irretrievable disaster. Knock out a linchpin and leave it, say I. One thing I would not do. I would not sacrifice a single life to save it, out of pure sentiment. Neither would I sacrifice a single life to save *any* gun, out of pure sentiment. I have often, at Aldershot, had our gun attached to my squadron; have often asked for it, if sent out to watch or oppose a superior force, feeling the great advantage which its presence

must give me, and have never yet seen a field-day when I should not have had an opportunity of using it with extraordinary effect. In conclusion, I may say that it is my firm conviction that a cavalry regiment armed with these guns as they should be, viz., four guns, one to each squadron, would be more than a match for any two regiments not similarly armed.

Captain R. S. BADEN-POWELL, 13th Hussars: After what Colonel Brabazon has said, there is not much left for me to add. In selecting our tools for any kind of work, we usually look to the particular sort of work we are going to do, and if we want to use a sledge-hammer or a tin-tack driver, we do not go and select a farrier's hammer that will do the work of both—equally badly. Lieutenant Benson has selected a very nice kind of machine-gun for general purposes, but I do not think he has fully considered the very different nature of the work that the various arms have to carry out. I do not think, for instance, that he has noticed the great difference between cavalry work and that of the other arms. To my mind there is as much difference between the action of cavalry and that of other arms as there is between an Englishman's way of fighting and a Frenchman's. The infantry and artillery fight the good old English way; they square up to each other and have i out hammer and tongs, but cavalry fight more in the manner of the Frenchman, who comes up to you, looks you straight in the face, clenches his teeth, and then suddenly lets you have a kick on the shins before you expect it. The success of cavalry fighting lies in sudden attacks from a most unexpected quarter, and for this kind of fighting I think the present cavalry machine-gun is the most efficient weapon that could be devised. It comes up almost unseen by the enemy, especially if it has an escort of six or eight men, who can mask it completely until they arrive within close range. With scarcely a pause, it can commence firing, pour in a rapid, deadly fire, and go on until the last moment with safety, and then bolt away for its life, if it likes. All the effect of this sudden and rapid action would be lost in the case of a gun that had to move with a limber and four horses attracting attention, and which, when it came up, had to unlimber before it could commence firing, and then to limber up again in good time to get away, if the enemy came after it. I think the infantry ought to have a gun of altogether another kind from that of cavalry. They ought to have tools adapted for their special work. Let cavalry have a cavalry galloping gun, and let infantry have an infantry gun, and, if necessary, have a general utility gun for the artillery if you like; but do not have one to act for all. The lecturer says that "with cavalry the machine-gun has nothing in common, except perhaps its power of rapid movement, for cavalry are supposed to act by shock, while machine-guns act by fire alone." Cavalry do not always act by shock. I suppose throughout the Franco-Prussian campaign any regiment you like to take, hardly acted by shock more than half-a-dozen times in the whole campaign; whereas pretty nearly every day they would be engaged in holding and seizing defiles, in occupying advanced posts, on outpost duty, in harassing the enemy's flank, in attacking convoys, in holding defiles when on the rear-guard in retreat. This is the usual sort of work which cavalry have to carry out on service, and for it the cavalry machine-gun would be the most powerful aid that could be devised.

Captain PALLISER: There is one part of the subject on which I wish to say a word, as it has only just been touched upon. That is, the wonderful shooting of the Maxim machine-gun. My opinion is, and it is a coming question, that this machine-gun gives the best shooting known, shooting that cannot be beaten even by picked marksmen in bodies. There has been some remarkable shooting going on lately, which is new to this meeting, and about which I must be reticent to some extent, because it is under Government supervision, and is carried out before the Committee. This shooting has been made not only at fixed marks, but in traversing from one mark to another at ranges of from 600 to 975 yards. In one case an Officer who had never fired the gun before in 75 rounds made 72 hits at 600 yards. I say that the admirable shooting of the machine-gun is the coming question, and I do not agree with Mr. Nordenfelt in the great merit of scattering fire. These weapons, when used in large numbers, whether made by Mr. Nordenfelt or Mr. Maxim, or other machine-gun makers, must be brought to this perfection; and then the conditions of war will be changed, because by their use ordinary soldiers will be able to

shoot as well and better, and in far greater volume, than even picked marksmen in numbers.

LORD CHARLES BERESFORD: It seems perhaps rather impertinent for a sailor to rise to speak on a subject so entirely connected with the sister Service, and particularly in the presence of so many distinguished artillerymen; but I have always taken such very keen interest in this question that I hope I may say a few words. There is one expression that I think ought to be altered in discussing this question, and it is one which has evoked a certain amount of discussion to-night, namely, the name that it is given to these weapons. I think they ought to be called "machine-rifles," because, directly you get into the question of "machine-guns," you have a discussion as to how they are to be mounted. On two occasions, at Alexandria, if I had had a machine-rifle that could have galloped, I could have sent a certain amount of help, and it struck me whether it might not be possible to mount the machine-rifles, so that a horse or horses could gallop with them. Directly the question of "guns" and "batteries" is produced, the limber and trail is discussed, but keep this machine as a "rifle," and it might be able to be put into action at a moment's notice. That is what passed through Captain Wilson, V.C.'s brain in the Soudan, because the time he lost in having to "Unlimber" and "Action right," "Action front," or "Action rear," the amount of time he so lost probably lost him a good many men, and prevented his being able to fight his gun at all. The object of the two wheels, either with infantry or cavalry, is to have the gun always in action. It should be able to train over its own wheels, and the mere dropping of the trail or the word "Halt," "Right" or "Left reverse," should put the gun immediately in action. I think it would be a very wise thing if the authorities would get rid of the expression "machine-gun," and as soon as possible use "machine-rifle;" for really, after all, this weapon is simply a cluster of long-range rifles. I must congratulate the lecturer on one of his suggestions, to the effect that something more practical should be done with this. It is very gratifying to us who have agitated for this arm for so many years to find an artillery Officer working out a paper of this description, coming as it does from his branch of the Service, which we have generally thought has been opposed to the machine-gun, principally, I believe, because it has been called a gun. I say it is very gratifying to find an artillery Officer who has brought the question so prominently before the public. The practical suggestion is, either that the obsolete 9-pounder batteries should be formed into machine-rifle batteries, or something of that character should be done, or that a Committee should be appointed in order to thresh this question actually out, because at present there are so many different opinions on the matter; although I think generally the Officers in the sister Service acknowledge that machine-guns have a very useful part to play in future wars. Of one thing I am perfectly certain, that directly we produce smokeless powder, they will have a most important part to play. I think the suggestion is very wise, that this weapon should not supersede any arm of the Service. Why should it? It is a new arm; it has capabilities that other arms have not got. As far as rifle-firing goes—as a cluster of rifles—it should no more supersede any arm in the Service than should our torpedo-boats or our submarine-boats supersede ironclads or cruisers. It is something else that has got to be counted on when you go into action, and as far as you can utilize it to knock your enemies into a cocked hat the better for you, but take care that they do not utilize it against you. You must be prepared to meet like with like, which is so important in all warfare. It would be a very serious thing if the German or any other army were to take up the machine-gun question, and we with all our practical experience, having found it so useful on so many occasions, were not to take it up and thresh it out as has been proposed. There is one thing more, in my humble opinion, and I hope I shall not be considered presumptuous in giving my opinion as a sailor; but I have commanded these guns on shore as well as afloat, and I think one of the principal points to realize about the machine-gun is, that it should be a unit. If you put it into batteries, if you put it into troops or into any section, or where the guns have got to work together under an Officer as a battery or similar formation, you would make a mistake. They should be essentially skirmishing clusters of rifles, and with each gun should be its own Officer. If you like to call them a "battery" or "troops," for marching in peace-time, do so, but the moment

they are put into action they should work in separate units; one man might go to a clump of trees or a bridge and hold them, and another man to another place, an Officer with each unit, and do something equally good; but directly you put them into a "battery," you will have a battery firing against them possibly. What is the result? You get hit on the flank and you are knocked out of action, as the French mitrailleuses were by the Prussians in 1870. The Germans had a holy horror of the mitrailleuses instilled into them, and what did they tell their artillery to do? They said: "Never mind what else you do, but as long as you see the mitrailleuse battery, devote all your attention to it;" and as these mitrailleuses all drew up in line and were worked as batteries, they were generally taken on the flank, and two or three shells put them out of action. I think the lecturer has given a most useful and instructive lecture, and I sincerely hope much good may come of it, and the machine-rifle introduced into the Service, as a new arm, to be utilized as the General commanding a brigade may think fit.

The CHAIRMAN: I am very glad of the opportunity of following Lord Charles Beresford. I think he needs no apology whatever for addressing us on this subject, because we know the connection which he has had with machine-guns all along. The suggestion that he has made as to the change of term and the use of the guns in very small units are, I think, most valuable. I should like to make a remark upon my own appearance here, as an Officer of artillery, in the chair. Seeing that the lecturer also belongs to that branch of the Service, it might appear as if the artillery had something specially to do with the machine-gun. But, in point of fact, except that the artillery administration—that is to say, the Director of Artillery—has to do with the bringing out of the gun, the artillery arm has nothing further to do with what are called machine-guns; neither have they any jealousy whatever with regard to them, as Lord Charles Beresford seemed to suggest just now. I think they have no jealousy whatever as against them; on the contrary, at one time I think they rather claimed, or were anxious to have more to do with them—to have more share in their management than has been subsequently accorded to them. I confess, at first my own feeling was that the artillery could very conveniently take them over; but I have come away from that way of thinking. I do not think there was sufficient ground for it. The weapon is an entirely different one from the artillery weapon proper; its aims and its powers are entirely different. I think the observations that have been made show that the action of the military authorities in putting these weapons in charge of the infantry and in charge of cavalry regiments has done an enormous deal to popularize the weapon; and I cannot conceive that in any other way could Officers, non-commissioned officers, and men have had the opportunity of making such intimate acquaintance with the weapon, than by making it for the time being an integral portion of their regiments at Aldershot. I do not think it necessarily follows that we should look to that as the end of all things as regards the organization of such weapons. I think in a campaign it must remain a rule, that an infantry regiment or battalion, or a cavalry regiment, will not always require to have a machine-gun with it. It might go over ground where such a gun could be absolutely of very little use, and therefore, I think, a General would wish to be able to attach a machine-gun to an infantry regiment or to any body of troops for a time. In order to enable him to do this, he should have a train of machine-guns, each gun as a single unit, and ready to go by itself, to be detached for any number of days to any point where its services were required. As regards the officering, it should be officered much in the same way as the mounted infantry are officered. So far as the infantry branch is concerned, it should be officered and manned in the same way as mounted infantry; that is to say, by men taken from the infantry. Similarly, you would require a body of machine-guns equipped to accompany cavalry, and that might be officered and manned by men taken specially from the cavalry, ready to be attached to any regiment which required its services, and in that way we should be able to get the greatest value out of the arm. In the meantime I think we have every reason to congratulate ourselves on the direction which has been given to affairs, and be assured that we are in a very good way, and in advance of most other countries.

Lieutenant BENSON: There appears to be considerable difference of opinion among cavalry Officers about these galloping carriages, as to whether they are to be

attached to cavalry regiments or not. Cavalry Officers present, I think, are in favour of attaching them to cavalry permanently. With regard to the two-wheeled carriage, there is a good deal of opinion here in favour of it, as well as against it. Its readiness in coming into action is certainly in its favour; but some gentlemen have said that the horses are intended to be unhooked, because if they are not unhooked the firing will become bad over 600 yards. If they are to be unhooked at all they might as well have the limber, because they can come into action very much more quickly with a limber and trail hooking on the limber than by unhooking the horses. [Captain BADEN POWELL: They can unhook it in about ten seconds.] I think the unlimbering can be done in two seconds. The horse artillery sometimes manage to get a round off within about five seconds from the word "Halt," if they are asked to do so. There was another objection made to having the guns in "batteries" or "troops," as I call them. I think, if for no other reason, they must be formed into troops for administrative purposes alone. I have said in my lecture it is easy enough to get forces to act separately which have been trained to act together, but it is a very different matter to get those to act together which have only been taught to act separately. Several gentlemen here think they ought to act together, and others separately. Probably the truth lies between the two: sometimes they will have to act together, and at other times separately; therefore have them in troops by all means, but have them able to act separately, if necessary. Major Smith, I think, got wrong about the weight of his carriage. He proposed that the carriage should be drawn by two horses, and said the weight was 17 cwt. The most a horse can draw at speed is about 6 cwt.; two horses would therefore draw about 12 cwt. The carriage that I propose weighs 25 cwt., and therefore can be drawn by four horses. In horse artillery the weight of the carriage complete is 36 cwt., which is actually 6 cwt. per horse. General Arbuthnot said the ammunition was separated from the gun when the gun was unlimbered. I do not see that that holds. The limber is 10 yards in rear of the gun, or nearer if desirable, and there is also a considerable amount of ammunition, about 1,000 rounds, in the axletree boxes. The total amount of ammunition carried in the galloping carriage is 1,546 rounds. Against that you have, in the carriage I propose, nearly 5,000 rounds in the limber and 800 in the axletree boxes, and you have your 10-barrelled gun, which is very much more powerful. General Arbuthnot also says that with the 10-barrelled gun ten bullets will hit one man. If the man chose to stand a yard off in front probably they would; but at all ordinary ranges the bullets would scatter themselves, and not go within two feet of each other. Mr. Nordenfelt will tell us how much ten bullets will scatter at 500 yards.

Mr. NORDENFELT: About six feet the 10-barrel; the smaller gun scatters more.

Lieutenant BENSON: I tried the 3-barrelled gun the other day, and found that at 30 yards' range it scattered over 5 feet during a few seconds of rapid fire from the light carriage.

Mr. NORDENFELT: The smaller guns scatter the most.

Lieutenant BENSON: At any rate, the ten bullets cannot hit one man. They might hit ten men, perhaps, standing up together.

General ARBUTHNOT: Ten barrels fired ten times would hit ten men ten times.

Lieutenant BENSON: They would probably hit the men in rear after those in front had been killed. I think that is all I have to say.

The CHAIRMAN: Gentlemen, we have listened to a very carefully drawn-up lecture, for which I think Lieutenant Benson deserves our very hearty thanks. We have also had a very interesting discussion which will not be without its value. I am sure I shall only be carrying out your wishes in thanking Lieutenant Benson very much for the good entertainment which he has given.

¹ Mr. Nordenfelt has since corrected this statement as follows:—"When the scattering gear is not used the 10-barrelled gun spreads over 10 feet at 500 yards, and 20 feet at 1,000 yards. With scattering gear the spread can be adjusted up to a maximum of 100 feet at 1,000 yards' range."—G. B.

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ERRATUM IN No. 141.

In the article in the Occasional Notes, "Lines of Communication in Modern War," by Major N. Walford, R.A., which appeared in last number of the Journal, the word "daily," in the 17th line, p. 841, should be omitted.

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OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

A FRENCH VIEW UPON THE TRAINING OF THEIR INFANTRY.¹

A Summary from "L'Éducation de l'Infanterie Française," by H. DE FLÈTRES.
Translated by Lieut.-Colonel BROOKE, late East Yorkshire Regiment.

"THE Education of the French Infantry" is the title of a volume of nearly 600 pages, written by H. de Flètres, who the editor of the "Spectateur Militaire" states is qualified for this task by his practical researches, his observations abroad, and by his personal experiences. At the time this volume appeared, a supplementary "Instruction for Fighting" had just been issued by the Minister of War, and the author applauds the doctrines therein laid down, but points out that if it is wished that troops should be disciplined during marches and in battle, it is necessary that this discipline should have been cultivated in the interior of companies and battalions, by means of incessant labours of all kinds, organized and superintended by the Captains and battalion commanders, in virtue of their own authority.

The book is divided into sixteen chapters, preceded by a preface, in which the author claims, that though a study of German military writings has led a certain number of Officers to seek to introduce into the army instructions based on them, but adapted to the national character; yet, an investigation by these same Officers of the correspondence, instructions, and memoirs of French Generals at the commencement of the century has proved that the successful innovations in the modern Prussian Army have been borrowed under various disguises from the national patrimony.

The author quotes a remarkable report by Marshal Marmont on the Prussian Army in 1824, as showing that the conditions and impulses governing this army at that period are still at work at the present time; contrary to the prognostication of the Marshal, who could not believe in their continuance. The report is as follows:—"The King caused the garrison of Berlin, 14 battalions, 22 squadrons, and a proportional quantity of artillery, to execute some grand manœuvres in my presence. The movements were

¹ "L'Éducation de l'Infanterie Française." Par H. de Flètres. Paris. A la Direction du "Spectateur Militaire." 1887. Pp. 532. Size 9" x 5½" x 1½". Weight under 1 lb. 10 oz. Price 8 francs.

made with extremely remarkable precision and rapidity. The fact which made these manœuvres so astonishing to me was that a third of the soldiers in the ranks was composed of recruits who had only joined their corps at the end of the preceding year. In four months they had been drilled, instructed, and placed on battalion parades. The Prussian manœuvres it is true are to-day the most simple in Europe ; formerly all was phantasmagoric in that army, everything was then most complicated. Service for three years only was established during the enthralment of Prussia from 1806 to 1813, and it has continued and still exists at the time of my writing. This system requires from Officers and men almost incredible cares and labours which ordinary times do not seem to admit of. The personal action of the King and the concurrence of all the Royal Princes have maintained up to now the initial momentum of the movement. It is a prodigy which must have its limits, for it necessitates unheard-of and constantly renewed efforts on the part of the Officers of the army."

The regulations of 1884 are next discussed, and their authors are accused of not only having prescribed a normal order for the fighting of a company, battalion, and regiment, but also for having laid down that this order of fighting shall spring into existence from the simple commandment "Battle formation," "March ;" the author pertinently asks, "Why not say 'Win the Battle,' 'March'?" That he has reason for his objections is shown in the new "Instructions for Fighting" in which the article in question has been struck out.

Passing now to the book itself, the first chapter treats of the conditions which ought to be fulfilled in educating the French infantry soldier. "This education in the first place must look after the 'morale' of the soldier, and must proceed by example and persuasion, and by making appeals to the generous sentiments with which all French people are so richly endowed. In punishing soldiers a strict line should be drawn between trivial offences or inadvertences, and unwillingness or premeditated disobedience ; in the former case, punishments should not be resorted to, in the latter an exemplary punishment should be inflicted."

"The relation between Officer and soldier should be simple ; aristocratic arrogance would be out of place, for the French Officer must remember that he belongs to a democratic country, and that though he occupies a position which has a feudal appearance, yet for this very reason it demands from him the most perfect tact and a thorough knowledge of the extent and nature of his powers. In the French Army a sufficiently sharp distinction is not made between 'on duty' and 'off duty.' When under arms, each superior should observe a firm attitude without affectation or exaggeration. At this time the friendly conversation should cease, the orders given should be clear and short, ensuring a rapid and energetic execution ; too much importance cannot be attached to this point, and its strict observance cannot be too strongly insisted on."

The intimate relations which should exist at all times between the commander of an army and its individual units is illustrated by quotations from the memoirs of the Napoleonic era, and the conclusion is arrived at "that the only infallible method by which a superior can obtain great efforts from his soldiers is by exposing himself everywhere and always. In order that an Officer may acquire the ascendancy which he ought to have over his men at all times, and under all circumstances, there is but one method. To give an example in the complete and strict execution of his duties ; *not to spare himself, to be always correct in appearance and conduct, and untiringly to look after his men everywhere and always.*"

Speaking to the text, that "three years is sufficient to form a soldier," the author says : "The method ought to be such that the soldier during the thirty

months he passes with his regiment should be always learning new things; while reverting frequently during the whole of his service to individual work, the basis of all instruction. Admitting that the recruits reach their corps on the 1st December, they should be ready to receive 'company instruction' by the 1st April. From this date all the company should be united for drills and manœuvres; but notwithstanding this the Captain should revert at times to the principles of 'individual instruction.' During the periods allotted to battalion and regimental instruction, the drills and manœuvres of the battalion and regiment only take up two or three days in each week. The rest of the time should be devoted by the Captain to the moral and physical education of his men, to squad drill and to company exercises and instructions. During the course of the second winter, the men of the last but one class should be exercised in gymnastics, in squad drill; and in field service exercises, in command of a small post, a patrol, &c. "The following year these same men who are not employed should fulfil the function of monitors to the recruits under instruction; it is not necessary to have learnt the theory of a subject in order to be a very good instructor. The division of the men of a company into classes of recruitment should be maintained throughout their instruction, in order that the highly gifted men may be made to progress without cessation. By acting on the above plan, the men passing through the army are returned to society, morally, intellectually, and physically improved. The regiment thus becomes the prolongation of the school, and its rôle no longer confined, as at present, to roughing out the men who come to it, and teaching them the elements of their professional duties."

Such being the author's general idea as to how the instruction of the infantry soldier should be carried out, he next criticizes the French soldier as he exists at the present time, and the following *résumé* of his opinion shows how very far from being realized are his views of what is right. Does the soldier respect his superiors? Travel in a railway carriage with reservists, and hear their distressing talk about their Officers. When the soldier quits the colours is he smart, and does he carry himself well? Alas! the moment he quits observation, he wraps his throat round with a comforter, and "pékinises" himself as soon as possible by borrowing from civilian clothes as much as he can. Have the men a proud and supple deportment? Does one feel that they have the vigour and agility which is due to judicious gymnastic training? With few exceptions they walk heavily, the head low, and the knees bent; so much so, that the day after their return to their homes, when they have put on their blue blouse, they cannot be distinguished from the other peasants by the most experienced eye. The above defects are then contrasted with the habits and customs of the German soldier, and it is plainly stated that they do not exist amongst their neighbours.

The next point observed is the injurious effect of carrying out all the training of a regiment by means of an elaborately detailed table of daily drills and exercises; this system takes all initiative out of the hands of commanders of companies and battalions, and reduces them "to the condition of pawns more or less richly laced, nothing else. A Captain has not the power to order an inspection, a manœuvre, or theoretical teaching, on any day or at any hour except that on which it appears on the regimental timetable. On the same day, at the same hour, at the same minute, all the soldiers of a regiment execute, for example, the manual exercise, at another hour and minute it is aiming drill, and so on."

The periods of employment of the Officers in a French regiment in winter are stated to be, including rests, from 7 to 9 A.M., and from 1 to 4 P.M., in all five hours; whereas the German Officer at the same season is at work from

7 till 11.30 A.M., and from 1 to 4.30 P.M., in all eight hours. Again, the hours of the soldiers' meals remain as fixed in 1833, viz, breakfast at 9 A.M., dinner at 4 P.M., in spite of the men having early morning coffee with bread. The Officers breakfasting at 11 A.M., and dining at 6 P.M., a useless waste of time takes place, and the author advocates the troops taking their meals at the same time as the Officers. It is also pointed out how the numerous roll-calls, dating from a period when they were employed to check desertion, exercise a bad influence on the training of the men, by Officers and non-commissioned officers being abstracted from their duties to attend them. The number of men employed on duties unconnected with their military training is touched upon, and an instance is quoted in which a battalion could only turn out ninety men for drill.

Credit is given to General Boulanger for having first tried to raise the moral and technical qualities of the infantry by the measures taken with regard to the *salles d'honneurs*, saluting the flag, the reception of members of the Legion of Honour, and above all by the giving to each grade the authority which is necessary for developing all its activities. To sum up, the author says "the French infantry have neither a definite object, defined doctrines, nor a method of instruction."

Having thus sketched out in general terms what the French method of instruction is, and what it should be, the author passes in review the nature of the instruction given in the German Army, and the tendency of that given in Russia, quoting extracts from Colonel Kaulbars' "Report on the German Army," Captain May's "Tactical Remarks on the War of 1866," "The Militar-Litterateur-Blatt," "The Gymnastic Instruction," "The Field Exercise Book," and "Letters on Infantry," by General Prince Hohenlohe, in support of his statements with relation to the German troops, and that of the manual of General Dragomiroff with regard to the tendencies shown in Russia. It is not necessary to follow our author in his wanderings through these works, as they are all well known to military students, and the opinions contained in them can well be ascertained at first hand.

The preparation of troops for war demands that the following conditions should be fulfilled:—

(1.) "Discipline the soldiers morally and physically by example, by word of mouth, by an intelligent system of gymnastics, by a succession of field exercises which give men confidence in their Officers and in themselves, and by making them skilful in handling their arms, smart, and vigorous.

(2.) "Form a corps of non-commissioned officers animated by such a spirit of duty, that in the absence of all control, the details of the Service and of instruction are observed with the most scrupulous exactitude.

(3.) "Develop to its maximum the power of a troop to rapidly pull itself together, even under the most unexpected circumstances, and inculcate in all the spirit of the offensive in all its forms.

(4.) "Inspire the Officers with a love of their career, the sacred fire of their profession, the spirit of emulation, and the sentiment of their dignity.

(5.) "Direct the instruction of commanders of all grades in a practical manner by basing it on the individual judgment, *coup d'œil*, handiness, decision, and energy.

(6.) "Form from all these elements a homogeneous whole, provided with traditions and animated with the purest patriotism."

"A centralized system, pushed to an extreme extent, regulations which go into details that are almost puerilities, are absolutely opposed to the realization of the above objects. In our days the army is the school of the nation, and all should be subordinated to the education and instruction of soldiers."

Quotations are made from "L'Armée selon la Charte," by General Moraud,

to prove that a French soldier can be made in three years, provided that companies and battalions are made autonomous, and the aptitude of their commanders judged by the state of efficiency they have brought them to.

Reflecting on the prognostications of General Moraud, the author goes on to say that "on all sides sighs arise on the degeneracy of the military spirit in France, and on the disgust that is felt for army life. 'The 'sacred fire' amongst the Officers is becoming extinguished little by little under the avalanche of papers, the minute regulations, and the circulars with which Ministers and their officers have overwhelmed the Army. The French Officer tends rapidly to become a clerk, who replaces with office hours the hours of drill. With few exceptions he is not a missionary of the religion of patriotism, who vows his whole life, and sacrifices his pleasures and his repose to form the hearts, spirits, and muscles of the soldiers, his children. How can it be otherwise, when all the details, even the most infinitesimal, of military life are regulated from above, by statutes which leave nothing to the initiative of commanders?"

A good account is given of the German Officer, extracted from the work already quoted, and from personal notes of the author. The French Officer is then described, and the following characteristics are noted: "After the war of 1870, it was admitted in France that we were defeated because our commanders were ignorant; having no knowledge of geography, and no idea of tactics and strategy. These reproaches were well founded. What was done to remedy this state of things? Were the General and superior Officers obliged to prove that they had wide knowledge, and could manœuvre skilfully? Not at all; but, on the other hand, the course of instruction at St. Cyr was made so complete and so extended, that if a student knew it all, he had only to get on a horse and take command of an army corps. But this student has yet to be found, the result really being that the young Officers coming from St. Cyr for the last fourteen years think that they know everything, while they know nothing. (Since General Boulanger was Minister of War, the course has been made more practical.) The other Officers who have been appointed Sub-Lieutenants before the institution of the schools of Avard and St. Maixent owe their advancement simply to qualities they had given evidence of while non-commissioned officers; and the statement attributed to Marshal von Moltke still holds good: 'The French Officers who have risen from the non-commissioned officer class possess no other instruction than that of the bad primary French instruction, and give evidence of gross ignorance, which we have very often been able to verify.'

"On the other hand, they have won from Von Moltke the following passage, to be found in the first pages of the "Franco-German War of 1870-1871": 'It was precisely these Officers who for the greater part strove on the battlefields of France to wash out, at the cost of their blood, faults for which they were in no way responsible.'

"Admitting that our military authorities frankly adopt with all its consequences the autonomy of the company, which entails that of the battalion, the first steps in carrying out the new system will be difficult. Those Officers who during twenty years or more have lived the present regimental life will be able to see nothing outside it. What more can be demanded from them; they are wise lambs, never get excited, are never noisy, and have only one little venial fault, that of seeking quietude by all possible means. *Natura non fecit saltus* is an old adage, and is specially applicable to men who have passed their fortieth year. It will also be necessary to take into account the disgust that certain commanders of corps will feel when their actual attributions are diminished to the profit of Captains of companies and commanders of battalions."

For these various reasons, the author advocates the adoption of a provisional battalion of instruction for each army corps, and a normal one for the whole infantry; "The former to be constituted at the headquarters of the army corps for a period of eight months from the arrival of the recruits until the 1st August in the following year. It would be composed entirely of recruits, with specially selected cadres; at the three inspections in April, June, and August, all the Captains of the army corps and a good number of the superior Officers would attend as spectators, and the result shown would be the standard from which the training of the next batch of recruits would be judged in each battalion. The provisional battalion having thus fulfilled its function would cease to exist. The normal battalion would serve as the standard of instruction; it would also be utilized as a battalion for experimental tactics, and a series of superior Officers and young Captains would be sent to it annually. The normal battalion would be recruited from the corporals recommended for the rank of sergeant, and who have promised to re-engage; each battalion would send two non-commissioned officers to it. The course would last from ten to eleven months, and the practical and theoretical teaching would comprise all that a Sub-Lieutenant of infantry should know, viz., gymnastics, musketry, drill, the process of setting up the soldier, topography, and improvised field fortification. A Divisional or Brigade General should be appointed as the permanent inspector of this battalion.

"Much has been done to improve the material position of the non-commissioned officers, and it is doubtful if more can be done in this direction, but it is quite otherwise with regard to the moral conditions of their lives." The author points out how the bugle call of each rank sounds far too frequently and harasses the non-commissioned officers, that they are drilled in the ranks as privates, under the privates' eyes looking out on to the barrack square. They are also placed under the Adjutant for practical theoretical instruction, and under the Captain for company exercises; each wish a thing done in their own way, and the unfortunate non-commissioned officer has to remember the ideas of each. Another evil that they suffer from is the repeating like a lesson portions from the drill book. These two latter factors act most prejudicially on the re-engagement of the sergeants, and many times they have been heard to say when leaving their corps, "I would willingly have re-engaged if I had only to obey one master, and if saying the drill by heart could have been dispensed with." The author considers that if the instruction of the sergeants were placed in the hands of the Captain, and his instructions tested by placing the non-commissioned officers in command of squads or sections of the company and seeing how they acquit themselves, the life of the sergeants in this respect would be made much happier, and they would re-engage. The following changes are also advocated: the permission to wear at their own expense, when not on duty, a uniform of a better quality; the establishment of a sergeants' mess; the cessation of the obligation to carry a rifle when on service; the issue of a smaller and lighter haversack than those used by the men, and the having their surplus articles carried in the regimental transport.

The preceding elaborate prelude to his main subject being concluded, the author commences a disquisition on the education of the soldier, and traces it through the individual stage, the squad, section, and subdivision. A brief summary of the salient points can only be given, and for the programme of exercises and the details, reference must be made to the work itself. The education of the soldier is divided into the moral, military, and physical, the two former being grouped together.

"The moral and military education of the soldier is too delicate, and

requires so much tact and general knowledge that it cannot be confided to sergeants; the Officer alone is in a position to give it. Numerous little books, patriotically drawn up and containing anecdotes taken from the account of wars in which our army has played a glorious part, bring clearly out the theoretical principles to be taught in the barrack-room. The class of book which is best suited for the instruction of the men are those which offer the double advantage of raising the spirit and being interesting, without aiming too high." The plan recommended is that "the Officer in teaching his men should seek to make them understand why they are soldiers, how it is that European nations have arrived at maintaining such enormous armies, by what succession of events our country has reached its present state, and what are the risks run by France in the case of another war. Afterwards it must be shown what is an army, and of what elements it is composed; what are the rôles of the different arms, and how victory can be obtained, and what are its consequences. The Officer must seek to make his men understand the correlation which exists between military virtues and success in war; he will explain the necessity of the formations adopted in the Service, and how they all contribute to the right employment of troops on the field of battle. It is necessary that the teaching should be simple and yet elevated in character. The Officer should sum up his military knowledge while bringing it down to the level of his hearers. Lastly, he must make his men acquire the conviction that military duties have a positive and practical object, and that if they are badly executed the destinies of the country may be called in question. Assuredly teaching thus carried out demands from the Officer a great deal of zeal and reflection; he must often catechize his hearers to ascertain if they have understood what he has said, to excite their attention, and to induce them to ask questions. If the teacher has the talent to give rise to questions, and if he knows how to make his men speak, he has already attained a very good result. The Officer teaching, after having shown the necessity for military duty, will enter into the details of its performance. He will teach not only the forms of respect, but also the polite usages which enable the soldier in the face of his superior to conduct himself like a well-bred man.

"The physical education embraces those movements which any soldier who is fit for war should know how to execute correctly and vigorously. Unfortunately the regulations draw a sharp line between gymnastics and the purely military exercises. We are therefore compelled to follow this subdivision, and to place under the head of military instruction all those movements of physical education which are not comprised in the manual of gymnastics. Military gymnastics is the art of harmonically developing the organs and making the soldier master of his movements, while augmenting his strength, agility, and capacity for enduring fatigue. They may be divided into supplying, developing, and applied gymnastics."

The physiological side of gymnastics is examined and the following quotations are made:—"An old physiologist, Jean Muller, makes the remark that 'Skill in bodily exercises consists as much in avoiding useless secondary movements as in producing the necessary ones,' and he adds, 'It is the suppression of these useless movements that produces the agreeable carriage and easy gait of the well-drilled soldier, of the consummate gymnast, and even of the well-informed and civilized man.'" A young and talented physiologist, G. Demy, states that "In every movement a group of muscles is brought into play. These associated muscles which contract simultaneously have been given the name of synergistic groups, and the correlation between the members of the group has received the term of synergy. When we wish to execute a movement, we first send out from our nervous centre an order or an excitation which passes along the spinal

marrow and the motor nerves to the muscles. These do not contract until after a certain lapse of time from the emission of the order from the brain.' Experimental research has proved that the rate of propagation of the nervous stimulus is at the rate of about 90 feet per second; and it is the difference between the time taken in sending the message and the interval of time between its despatch and the commencement of the ordered movement that Helmholtz calls "lost time." This lost time, the author says, diminishes in the soldier proportionately as he becomes more and more familiar with the movements ordered.

"The order sent from the brain contains everything relating to the intensity and direction of the movement, and we are no longer master of it when we have given out the order. Certain complex movements necessitate at first sustained attention, afterwards, from constant repetition, we execute them unconsciously, almost automatically. At the commencement of the exercises the movements are unco-ordinated; if they call from the learner a considerable effort all the muscles are contracted; and this is due to diffusion in repeating the order or in the central excitation. The will can regulate this confusion, or give the right direction to the central excitation, and thus prevent useless contractions taking place. It is therefore possible to perfect the co-ordination, for all useless contractions are hurtful, and all co-ordination, at first voluntary, ends by becoming definitely acquired, and constitutes an unconscious synergy which has no longer any need of the assistance of the will." *The acquisition of this co-ordination is a genuine physical improvement, on it depends the accuracy and precision of the movements which result in suppleness and skill; moreover, the principal fact which is the consequence of this distribution of the work of the muscles is a great economy in the sum of the mechanical work produced in each of the movements; the possibility of executing these movements a greater number of times, and, lastly, the pushing back the moment when fatigues commences.*" ("L'Éducation Physique" par G. Demeny.)

"Suppling gymnastics are by far the most important.* They suffice in themselves for the harmonical development of the body, for they enable a man to reach a high standard of agility, or what is the same, give him the faculty of co-ordinating his movements with a view to overcome the most varied physical difficulties." These gymnastics comprehend: (a) elementary exercises on the parade ground, without arms and with arms; (b) boxing, which is in France a succession of various attitudes necessary for attack or defence, and which produce very valuable physical qualities in the soldier; (c) marching exercises, which have the double object of endowing men with the power of breathing easily in spite of accelerated movements, and teaching them the gymnastic pace; (d) running drills and elementary jumpings.

"Developing gymnastics comprise those exercises which are executed with some form of apparatus; their object is to endow a man with extra skill and vigour, by teaching him to overcome greater and greater difficulties. The recruits should commence this instruction at the end of their second month of service. The trained soldier should practise these gymnastics concurrently with the suppling gymnastics throughout their stay in the regiment."

"During the exercises of developing gymnastics the lightly-clad soldier has learnt how to conquer artificial difficulties; it is now the question of their making use of this training by overcoming natural obstacles on the ground, by getting over or escalading the obstacles they might meet with in war, having their arms and equipment on as if in the field. Applied gymnastics ought not to be taught to the recruits until after five or six months' training in developing gymnastics. The old soldiers should only practise them in fine weather, and when the ground is dry, in order that, if falls take place, they will not be grave ones. These exercises should be carried out at first without

arms and in light clothing, afterwards with arms, then with the valise, progressively weighted, and, lastly, in field service order. Gymnastic training should be carried out concurrently with the purely military training; these two branches of the soldier's education are in a fashion blended, and in all cases mutually aid each other."

"There is a branch of military education which ought not to be passed over in silence, although, apparently, it is only of secondary interest; we would speak of military songs. However repugnant it may be to hear a French soldier shouting out idiotic songs followed by choruses worthy of baboons, yet, undoubtedly, we love to hear the manly and energetic accents of young men celebrating in rhythmical songs the warlike virtues of the soldier, and the love of the native land. Singing classes, considered as a recreation even by the soldiers, could take place for half an hour a day, and five or six marching songs could be learnt in three months, and a dozen after six."

"The purely military and practical instruction of the soldier comprises a very small number of subjects, if one adopts a logical distinction between that which a soldier should know as a unit, and the obligations which are attached to a group formed of a certain number of men. To March and to Fire are the two points of the elementary instruction of the individual. Field service instruction utilizes these two aptitudes, and makes use of them for the solution of small concrete problems, in which common-sense and a good judgment occupy the principal rôle."

"The individual military instruction of the soldier comprises: the military position, changes of front at the halt, marching at different paces, and turning while on the move, the management of the rifle, rifle fire, the duties of a sentry in peace-time, the duties of a skirmisher, sentry, look-out, and flanker in the field. When the soldier has mastered the exercises which serve to teach him the above, a few drills enable him to learn to take up his proper position in the squad, section, and company."

"The instruction of the squad in fighting order does not offer many difficulties if its commander knows his work, and especially if a too rigid adherence to distances is not insisted on; for example, 'to measure in centimètres the distance between files,' which operation we have seen performed by a commander of a regiment. In France, the squad has been chosen as the sub-unit of deployment in the skirmishing line, the section being the unit of deployment for the company. The importance thus given to the squad, an importance which the regulations have immoderately increased, is not without its inconvenience, but at the same time it has its advantages. It habituates the lowest rank of non-commissioned officers to command effectively, and it enables the subdivision to be readily broken up. On the other hand, these minute autonomies encumber and complicate the extension of the subdivision into skirmishers, and at times make the soldier hesitate as to his movements. On the battlefields of Europe the squad will be completely effaced, and an Officer must deem himself happy if he is able to direct the movements of his subdivision. However this may be, we have the system of deployment by squads; let us keep it, while seeking to mitigate its defects."

"Instruction in the subdivision should commence directly the squads can march accurately to their front and flank; it can be pursued concurrently with squad and individual exercises. At the end of each period the exercises practised in squad formation should be carried out by the subdivision. It is necessary to make the instruction as varied as possible, and the system which consists in going straight through the drill-book dulls and wearies both instructors and men. For the same reason that a man cannot usefully employ his limbs, unless they have been supplied and made ready to receive the orders emanating from his brain, so a subdivision needs, in order to acquire its special qualities, that the organs of which it is composed shall be

supplied to enable them to execute the movements which make of the whole unit a pliable and manageable organism. The exercises which are directed towards supplying the subdivision, in view of the eventualities of war, stimulate and excite the attention of the men, and force them to make use of their intelligence, skill, and agility. They associate each man with the success of the ordered movement, and in consequence develop the individualism of each. These exercises are as follows, and can be executed without arms at first, and as a recreation :—(a) rapid alignments ; (b) wheeling into column of squads or sections, and re-forming the subdivision ; (c) changes in direction ; (d) forming single rank from double rank, and *vice versa*." These supplying exercises having trained the subdivision to change its form and move rapidly in any required direction, are made use of in teaching the men their duties when in extended order. These learnt, a series of exercises connected with outpost and advanced guard duties are taught, and the training of the subdivision is concluded by manœuvres illustrating the attack and defence.

The details of company training are preceded by the following remarks, which show how strongly the author insists on continuing the individual instruction of the soldier throughout his training : "The soldier loses very quickly the qualities of accuracy of movement, quickness, and attention which individual instruction has with great labour inculcated in him, when, being placed in the ranks of the company amongst many other men, he sees his faults pass undetected. It is necessary, therefore, from time to time during the whole length of a soldier's service, to put him back to individual and squad work, and to require from him incessant progress. Acting in this manner one follows the example of the good horseman, who after some days' hunting or a lengthened road journey, goes on his return for an hour or two to the riding school, to re-establish the equilibrium of his horse, to supple it morally and physically, and to make it light both to hand and leg ; in one word, to tune the instrument. Manual exercises, firing, charges, the filing by singly, in files, fours, and in squads and sections in open order, are the most useful exercises with which to keep the soldier well in hand."

The value of the bayonet exercise is pointed out, "but owing to the native impetuosity of the men the blows received while fighting with each other are heavy enough to break the ribs ;" in consequence, the use of sticks having a well covered wooden button at one end is advocated, and a detailed programme of exercises is given.

"As rifle firing is a special gymnastic demanding continuous application, it is necessary that the soldier should aim and do position drill every day, even if only for a quarter of an hour."

With regard to field works, it is pointed out "that a distinction must be made between the knowledge that a non-commissioned officer should possess and that which can be demanded of a soldier. The latter should know how to use the pick and shovel, to make withes and straw bands, to bring together branches and form them into fascines. The non-commissioned officer should be able to direct the construction of a shelter trench from a plan containing all the necessary dimensions ; he should know how to make a foot bridge across a small stream, to construct a cooking place, latrines, shelters from wind and rain in a bivouac, utilizing for their construction billets of firewood and straw, which are found everywhere." The remainder of the chapter, which treats of company training, follows the routine of most courses of instruction, and need not be further quoted, though the exercises and manœuvres of outposts and advanced guards, the field service exercises, and company manœuvres, are full of interesting matter, and will well repay perusal.

"Up to the present we have only been occupied with the means of giving the company a suppleness, rapidity, and accuracy of movement necessary to

make it a supple and muscular unit of action, capable of free movement in all senses, and able to develop at any given moment or place all its fighting capacities. But before passing to the study of the formation and evolution of a battalion, it is necessary to glance at the conditions under which it acts on the field of battle." The tactical conditions of the battle of Gravelotte are taken as an illustration; and the actions of a German and French General in the field are contrasted. "The former does not concern himself as to how the troops will arrive at such a point at such a moment, but utilizes all his mental power in striving to obtain an exact appreciation of the situation, for from this appreciation springs his dispositions and orders for the battle. The French General, on the other hand, when he wishes to manœuvre a division, finds himself obliged by the regulations to combine long and complicated movements, in order to cause the troops to arrive without disorder at some point other than that at which the initial concentration takes place. To make a comparison, the German General is like a good horseman, who has not to think of his horse, but instinctively directs its movements while carrying his thoughts elsewhere; whereas a French General is like some of the battalion commanders of other times, who almost lost the use of their voice when they had got astride of their nags. To sum up, it is of the first importance that our infantry should be rendered capable of manœuvring freely; by this we mean that a brigade, division, or Army Corps should be able to move with facility in a concentrated formation in any direction, to modify in a moment the direction of its march, in order very rapidly to take up a fighting position from whatever formation it may happen to be in at the time."

From the above is deduced that the most advantageous formations for infantry can be divided into two great categories.

"(1.) Formations for manœuvres and evolutions.

"(2.) Deployed and fighting formations.

"Manœuvre formations require the assembly of the greatest possible number of individuals in the hands of a commander, who is able to move them as one man; in consequence they are all derived from the column. A manœuvre formation ought to be well articulated; by this is meant that it ought to be a conglomeration of units capable of turning on themselves and of dilating in every direction. In the French infantry, the double column and the battalion column are the regular formations for manœuvres; but they are not adapted to evolutions in the proximity of the enemy, for the double column is not flexible, and the battalion column is too deep." To meet this difficulty it is proposed to constitute the company with three subdivisions instead of two, and the argument is well worked out by the author. The action of the battalion is next considered in deployment, and afterwards in offensive and defensive action.

"Field firing, borrowed from Germany, and wisely adopted in France, has been applied with such a series of administrative minutiae to ensure uniformity, that it well illustrates the capital defect in our national character. Whereas a Prussian Colonel arranges with the sub-prefect of the district for carrying out the field firing of his battalions on suitable ground, and for taking the necessary precautions to ensure the safety of the inhabitants and the security of their interests, our field firing is regulated in its minutest details by superior military authority. And in order not to frighten or derange the inhabitants, it is directed with few exceptions that field firing shall take place on the artillery practice grounds, there being one in the territory of each Army Corps. In consequence, the eight regiments of the Army Corps pass a few days each year on these grounds, and have often to make marches of from six to eight days to reach it. Once there the men fire in a line at the objects prepared for them, and which are always the same. There is no power of manœuvring, as the practice ground is only 200 to 300 mètres

wide. The Officers soon learn the distances just as accurately as on a range, and thus this firing, which is supposed to train Officers to conduct the fire of the men, completely misses its object. At the very most this kind of field firing accustoms the soldier to the noise of firing and the whistling of bullets; and a good deal of money is spent with very little profit to the soldier's instruction. How is it that in France we have such a blind passion for uniformity? If a regiment is stationed in an unfavourable country where field firing cannot be carried out as it should, let the practice drop, or every two or three years send the regiment to a place where the firing can be carried out on suitable ground."

"Judging distances beyond 400 mètres is one of the greatest difficulties when directing infantry fire. The errors in judging at a distance of 700 mètres when the ground is undulating, having hollows or projections, or when the air is not clear, are often very great: thus, one observer puts the distance at 600 mètres, another at 800, and a third at 500. It is a good thing when firing has to take place at distances beyond 400 mètres, to take the observations of three individuals (Officers, non-commissioned officers, or even privates if they have been brought up in the country), and to select as the correct distance the mean of the three observations. For example, the distance is 700 mètres, the observations are 500, 600, 800 mètres, the mean therefore equals 633 mètres, and the sight for 650 mètres would be used, and the resulting fire would be good." The employment of different sights by the Germans when firing at moving objects, or at distances beyond 400 mètres, is discussed; and the effect of fire in relation to the slope of the ground is also gone into.

"It is in battalion manœuvres that the professional instruction of Captains and Subalterns is developed; the manœuvring of company against company enables the commander of the battalion to judge if they have been well instructed in the rôles of offensive and defensive action. These manœuvres should be so organized as to leave the Captains in complete ignorance of the effective of the enemy, and in the impossibility of communicating their respective schemes to each other."

"For example. The commander of a battalion orders the first company to leave barracks at 5.15 A.M., the second company at 5.30, the third at 5.40, and the fourth at 5.50. All the companies take white cap covers, but for the present carry them in their pockets. The commander of the battalion, who has been on the parade-ground from 5.15 to 5.40 A.M., gives each Captain a sealed envelope, on the outside of which is written: 'This company will march by such a route, to such a place, where this letter will be opened.' Each letter will contain, (a) the general idea; (b) the special idea of the side to which the company belongs; (c) the name and rank of the commander of the side; (d) the special rôle attributed to the company; (e) whether the white cap covers are to be worn or not. The places at which each of the four companies are to rendezvous should be so chosen that each company should not be able to see the movements of the others. As a general rule, the times for leaving the several rendezvous places will be so calculated as to make one company encounter two companies, then another company will arrive in support of the single company during the engagement; thus the fight will terminate with equal forces. Such dispositions require from the battalion commander a thorough knowledge of the ground over which the manœuvres will take place; and the minutest care in the calculation of times and distances. We may here say with Napoleon: 'All that is not profoundly studied in its details produces no result.'

"Battalion manœuvres should not be limited to the simple encounter of companies and subdivisions belonging to the different sides. It is necessary to interpolate in the schemes set: outpost duty, duties on the march, flank-

ing detachments, requisitions, demolitions, &c. The entire battalion ought to carry out at least one bivouac exercise with outposts, employing an afternoon and the whole of the succeeding night. Cantonment exercises with or without outposts are also very useful, but the number should be limited to two or three on account of the little difficulty and little interest they give rise to. The question of cooking food while bivouacking is very important, and the method of utilizing the scanty resources of an exhausted country must be studied. The troops should be taught the best means of cooking and preparing the reserve ration, and the ordinary food stuffs of central Europe."

"Marches, called military, date from a bygone age, and though this weekly hygienic march was useful at the time it was instituted, it is so no longer when the soldier works from morning to night; yet it still figures on the list of exercises as if it could produce a serious result on the training of the soldier. In marches two results have to be contemplated: the first and most essential consists in developing the locomotive faculty of the soldier; the second relates to the enforcement of discipline so requisite in the field. If the ordinary training of a company is carried on with the proper amount of intensity, it is only necessary at a certain period of the year to ascertain the results from the power of resistance shown by the men. Then and then only should successively graduated marches be employed in order to bring to light what the men have gained with regard to wind, muscular development, and suppling of the body. Such marches, carried out during the fine season, at the rate of 10 to 25 miles a-day during four or five consecutive days in each month (April to August) ought, besides training the men, to give the means of classifying them as good, medium, or bad marchers; and further obliges them to give that attention both to their feet and boots which these two very important objects demand."

"What is understood by the term training? For those who are specially occupied with the question, training is a wisely calculated succession of efforts progressively increased, in accordance with the daily food, and the capacity of the individual undergoing the regimen. A man whose ration is sufficient for the ordinary circumstances of the Service requires, when he expends himself in excessive work, to have a more copious and nourishing diet. The *sine quâ non* condition of training lies in its continuity. A soldier who makes a great effort once a week does not train himself, he is tired on the day he does the excessive amount of work, but he recuperates in the succeeding days by doing very little. If the ordered work is beyond the available revenue, the capital is drawn upon, that is to say, the constitution itself, and consequently the health. The object of training is therefore to increase the available forces, considered as the revenue of a locked up capital."

To carry out the above object, the author proposes that the last few days of April, May, June, July, and August should be devoted to marches, progressive both with regard to distance and to the weight carried by the soldier; he appends a detailed programme, and claims from its use the following advantages: "1st, The soldiers, knowing that they have to make four consecutive marches, will prepare themselves for it by greasing their boots and preparing the greasy bandages for their feet. 2nd, After each march the non-commissioned officers, and subsequently the Officers, will inspect both the boots and feet. They will ascertain if there are any signs of commencing chafes and blisters, and they will take care that the men employ the well-known remedies for sore feet. 3rd, At the end of the fourth march, the good marchers will have differentiated themselves from the bad ones, and the Captain will be able to take stern measures with those careless soldiers who have allowed their feet to become sore through their own fault. These training marches should take place by companies in April, by battalions in May, June, and July, and by regiments in August. The routes taken

should be such that the first return to barracks should be when two-thirds of the march has been completed; or the breakfast may be carried with the men, and it can be eaten on the grass far from a village. During these marches it is necessary to increase the ration of the soldier, obtaining the necessary funds from economies realized during the winter and during the assembly of the reservists. Lastly, all modifications in dress or equipment with the object of easing the men must be ordered by the commander of the marching column, and not be left to the initiative of his subordinates, and least of all to the soldier."

An interesting tactical account of the German manœuvres of 1879 and 1886 is inserted, based on the author's notes taken from day to day during the manœuvres. It is well worth reading as exemplifying the tactical tendencies of the German Army of to-day. The next chapter is devoted to formations to be taken up by a brigade or a division in proximity to the battlefield, and not under fire; the object being that each formation should be carried out with ease, order, and rapidity. In summing up the result of his study of these formations, the author states that "for the great tactical units there is not a single unique formation for fighting, as there is for the little ones," and rests his conviction on the following words of Napoleon: "One cannot and one ought not to prescribe anything absolutely. There is no natural order of battle in modern armies."

To illustrate the spirit in which the fighting exercises of a brigade or division should be conducted several examples are given, and amongst them is the following:—"An enemy's position, with a front of 300 metres, is represented by hand-flags; the division (brigade) deploys a brigade (regiment) in front of it, and engages in a demonstration or temporizing action; the other brigade (regiment) in the meanwhile is directed under cover on a point where it can debouch, either in the preparatory or fighting order, and attack a flank by approaching it obliquely. Concordance in these two attacks (frontal and flanking).

(a) While the decisive attack is being made by the out-flanking brigade (regiment), the enemy is supposed to make a counter-attack against the exterior flank of the other brigade (regiment). The rôle and movements of the troops in the second line and in the reserve.

(b) While these two attacks (front and flank) are being carried out, an order is given to break off the fight; the echeloning of the brigade (regiment), and the occupation of the position in which the troops have to fall back. The formation of a rear guard and the passing from a deployed order to a marching column."

"Garrison manœuvres have been lately ordered to take place, but they can be of but little interest unless the garrison is composed of a regiment of infantry, at least two squadrons of cavalry, and one or two batteries. In those cavalry garrisons which have only one battalion of infantry, the garrison manœuvres should only consist of outpost and advanced guard affairs." Supposing the garrison to be of the needful composition, the author sketches out how the forces may be usefully manœuvred after the harvest has been gathered, but no special point of interest is evolved.

"In France the infantry reservists are called back to the colours at the time of the autumn manœuvres. This regrettable measure was adopted from the necessity of giving companies, battalions, and regiments an effective capable of manœuvring. The strength of the company being fixed at 66 men, which, however, it never reaches, and out of which 30 or 40 men alone are able to handle their arms, the question arose as to how manœuvres could be carried out, and the answer was given, 'recall the reservists to the colours.' This decision was enthusiastically received. Was it not offering a true picture of the conditions of war to make those participate in the manœuvres

who would on mobilization bring the effectives up to the war strength? Certainly! but our reservists beforehand will only have acquired a stunted and superficial military education, because from want of effectives and of independence, their instructors, from the Captain to the corporal, will have, as it were, done their daily task without interest and without zeal. In confounding the instruction of the men with the instruction of the commanders a mistake has been made."

"The Germans have clearly defined the object of small garrison manœuvres, and of those carried out in the autumn. The organization of their great manœuvres is conformable to the division of the instruction of the army into two distinct branches: the instruction of the troop, and the instruction of the commander. If the commanders of corps recall to the colours some reservists to fill up the vacancies at the moment of the grand manœuvres, this recall does not in any way resemble the deluge of men, trained or not trained, which pours into the French regiments at the moment when the instruction of the commanders is alone in question." The German regulations on field service expressly state: "In manœuvres based on the ground utilized, the instruction of the men is the principal object for small detachments, such as a company, squadron, or battalion. It is only with large bodies of troops composed of the different arms that manœuvres are now specially applied to the instruction of commanders; and in this case Officers may fill the position of a rank superior to their own."

"However this may be, the system adopted in France will continue to exist for many years. It is therefore necessary to take it as it is, and while seeking to correct its fault, benefit by the special advantages it possesses; amongst which, the most important, and perhaps the only one, is the placing in the hands of the Officers large effectives, closely approximating to those they will have to handle in war." For the sake of argument the author assumes that the infantry reservists join the colours on the 1st September, and quit them on the 28th; a series of exercises for this period are given, and a hypothetical manœuvre of an infantry division is treated in detail; a map attached to the text renders the whole of a very complete scheme thoroughly understandable.

"The circulars of 1878 and 1884, which regulate the annual course of instruction in infantry corps, abound in excellent intentions, but each line reveals the inability to give to the different units, company, battalion, or regiment, the means of acquiring under the direction of their immediate commanders the qualities which are the foundation of all good troops. Unceasingly is seen the amalgamation of several units to form one manœuvre unit drilled by an Officer superior in rank to its proper commander. Thus a battalion commander becomes the instructor of the manœuvre company furnished by his own battalion, and the Lieutenant-Colonel is the instructor of the battalion formed from all that could be collected from the regiment. The opposite system to this would be the most logical, and the intermittent command of a unit should be given to an Officer below the rank of its habitual commander."

"But let this pass, and let the future be looked at. The approaching application of the system of three years' service for the soldier will provide the infantry with the effectives which they have long needed; and during six months of the year from 1st April to 1st October the regiments will be gorged with men. The scheme of the Organic Law on the Army which is going to be voted by Parliament does not make use of the words 'six months' furlough for the trained soldier,' in order not to scandalize the public; but at the same time it does establish the system, and we are not frightened at it. We will be less discreet, and say that from 1st October to 1st December the companies will be deprived of the majority of their old soldiers, and during

this time the cadres will enjoy their well-merited rest, and prepare themselves for the instruction of the recruits. These latter arrive on the 1st December, and from thence till the 1st April the time will be devoted to their instruction, and further, the fifteen days allotted to brushing up the old soldiers on their coming back on the 1st April from their six months' furlough will be utilized for instructing the recruits. Thus the first period, which embraces the education and instruction of the recruits, including the drills and manœuvres of a subdivision, will take up four and a half months, that is, from the 1st December to the 15th April. The company instruction will then commence and extend to the 1st June. Battalion instruction will take place between 1st June and 1st August, and during this period the company will be perfected in all the branches of its instruction. This will be still further carried out during the regimental instruction which will last from 1st to 30th August. Lastly, on the 1st September the reservists are recalled to the colours, and the autumn manœuvres are carried on until 28th September."

The author traces out in periods the work, or the employment of the time, which he thinks best adapted to the necessities of the instruction of the soldier, while being sparing of his strength, and giving to his work the greatest possible variety. "The division of work which is sketched out is not absolute, it can and should be varied in accordance with the origin of the contingent, the climate, and the peculiarities of the surroundings."

"The instruction of the recruits is divided into weekly periods, as is the custom in the French Army; each Captain draws up on Saturday the table for the following week's exercises, taking into account the results already attained, and the faults that have to be corrected."

"In instructional establishments the necessity for a whole afternoon's rest in the middle of the week is well understood. Why should not the army, which is pre-eminently the school of the young generation, on reaching manhood follow the same course? Commanders, who misunderstand the exigencies of human nature, require from their men energetic work for from six to eight hours every day except Sunday. By so doing they defeat their own object, and lay the seeds of discouragement, inertia, and indiscipline. Rather, the afternoons of Wednesday and Saturday should be given to the soldiers for rest, cleanliness, the repair of clothing, cleaning of arms, &c., the men being confined to barracks as usual up to the dinner hour. Sunday should also be a day completely free. However, there are no rules without exceptions, and when musketry is in full swing, the Wednesday afternoon's rest might be omitted; again, when a company manœuvre takes place on this day, the rest might be taken on the succeeding one." Tables are inserted showing the details of the instruction to be given in each week to the recruits during the first period of their instruction. In the last week of this period, the inspection of the recruits by companies by the Colonel of the regiment is proposed to take place, and would be at the rate of three companies a day; in all four days would be taken for this duty; a scheme for these inspections is given.

The details of company instruction having been previously given, a table showing the division of the work is alone added, and the method of conducting the inspection of the company is next dealt with. It is suggested that companies should be inspected by a General of brigade, who would be able to inspect the four companies of a battalion in one day. The time being thus distributed: from 6 to 10 A.M., first, fighting formations at the discretion of the Captain; secondly, a company manœuvre, the problem to be solved being set by the General himself; from 1 to 3 P.M. company drill; and from 3 to 5 P.M. gymnastic exercises.

"The instruction of the men does not go beyond the company, the drill

and the manœuvres of a battalion are for the instruction of the Officers. The drill movements of the battalion, nevertheless, contribute to the cohesion and uprightness of the men, while obliging the commanders of subdivisions to keep up a rigid attention to ensure that the movements are carried out with absolute precision; but when the fighting exercises are reached, each company acts as a complete organism, and the talent of the commander of the battalion is shown in the method with which he handles the companies."

"In analogy with the proposition made that a General of brigade should inspect the companies, similarly a General of division should inspect a battalion. In Germany, where the system of periodical inspections has been at work for a long time, it is the divisional General who inspects the battalions. Prince Hohenlohe describes, in his ninth letter on infantry, how he organized his inspections; and amongst the French Officers who have read these remarkable letters, none will refuse to approve of the course adopted, stamped as it is with good common-sense, and a profound knowledge of war. In one morning General Hohenlohe inspects two battalions, at drill and in fighting formation; the first takes from thirty to forty minutes, the second about two hours by battalion. The afternoon is devoted to the inspection of the different branches of the administration. Nine days are thus occupied in inspecting twelve battalions, including the time taken up in travelling and a Sunday."

The following is Prince Hohenlohe's description of his method of conducting the inspection of a battalion, and it is given *in extenso* as coming from the pen of one of Germany's most distinguished Generals:—"I commence the inspection of a battalion, as all other inspections, by passing down the ranks, and a march past. Nothing teaches you better how the men have been treated by their Officers than the expression of their faces when going down the ranks; but fatigue would also alter the physiognomy, if the men had been kept waiting a long time under arms. To obviate this inconvenience, I had ordered that the troops should await my arrival before unpling arms. On the other hand, I was not disappointed to see how they acted while taking up all the formations that are usual in such cases; this was a test of discipline."

"After the march past, I allowed the commander of the battalion half-an-hour or even three-quarters of an hour, in which to drill the battalion in battalion movements, leaving him perfectly free. The assembly of the battalion took place later on, at the time of the fighting exercises, when it had been well mixed up in consequence of some operation. These three-quarters of an hour were sufficient to ascertain whether or no the battalion was perfectly conversant with the regulations concerning the movements executed on the word of command of the battalion commander himself."

"After a short rest, I commanded the fighting exercises to commence. I directed them myself, in this sense, that I gave the commander of the battalion some quite simple problems to solve, marking the position of the enemy with some flags. In solving these problems I required that he should give the orders and have them executed as if a real engagement were in question. I did not permit other movements, or other commandments than those which were in accordance with the regulations. The commander was not permitted to furnish his Captains with fuller explanations than were required to make them understand the suppositions of the scheme set, and the signification of the flags; nor, above all, more explanations than he would have been able to give them in the case of a real engagement. I took care that the commander of a battalion should place himself where he would have been in a real fight. If one of the companies or subdivisions, heavily engaged, made a mistake, I did not allow the commander of the battalion to

send it a counter-order. I required him to base his ulterior dispositions on existing facts, as in warfare. The subordinates had to determine the nature of the fire to be carried out and its intensity; they were free to choose between advancing by groups (line of sections or squads) and in line of battle; or in column, and in what sort of column; but they were responsible for all their decisions and dispositions, such as to make the men lie down, to make them double; and they were obliged to give their reasons for their orders."

"In choosing the themes myself I was sure of removing all misplaced strategy from the field of manœuvres. I was also able to prevent the representation of an action from lasting too long by making some incident arise; such as a charge of cavalry, or the apparition of fresh troops of the enemy, obliging the troops to pass from the offensive to the defensive. From constant practice I acquired such facility that I could set a battalion to solve two or three problems in the space of an hour. For the sake of clearness I will quote as examples some of these schemes. (1.) An isolated battalion defends some object (a field work, a shelter trench, a forest). (2.) An isolated battalion makes a direct attack on an object (in order not to lose time, sometimes the first 500 mètres of the attack was carried out, at other times the last 500 mètres). (3.) A battalion of the advanced guard surprises the enemy. (4.) Or is surprised by it. (5.) A battalion is sent against the enemy's flank and succeeds, ready formed for attack, in suddenly appearing 300 mètres from the enemy. (6.) In an offensive action, the battalion belonging to the brigade, and posted on one of the flanks, takes part in the fight either in the first, or in the second line. (7.) The battalion posted as the last reserve at the centre has the mission to strike at all hazards the decisive stroke in a musketry engagement, in a very undecided action, and to carry forward with it in a general attack the corps already engaged. (8.) The arrival of reinforcements, or the attack which the enemy directs on our flanks, forces the battalion to pass from the offensive to the defensive, or to retreat and *vice versa*. These eight cases alone give more than twenty combinations, varying with the extent and configuration of the manœuvre ground. I give rise to a much greater variety still, by supposing in the middle of the operations a charge of cavalry, either the enemy's or ours, or by notifying that the commander of the battalion has been placed out of action."

"After the inspection of the fighting exercises I make the battalion march past again, but in a different formation to that employed the first time, directly after my inspection of the troops in line. I consider this second march past as a reward, a solemn finale for the troops, to whom I afterwards address a few words of encouragement."

The author next briefly discusses how the instruction of the regiment should be carried out, and a time-table of the exercises is added. The Autumn manœuvres constitute the fifth and final period of instruction.

A chapter on the professional instruction of the Officers opens with the following quotation:—"Each day it is necessary to efface, correct, create. To remain stationary for a single instant, that is to say, to be a conservator without discrimination, is willingly to expose oneself to cruel surprises and to unmerited disasters."—(Yung.)

"Generally, the man whose mind has been cultivated during his youth is capable of learning up to the age of thirty-five, after which he applies what he knows. The highly gifted natures progress without ceasing. Up to the present time our Army has produced a very small number of commanders ripened by experience, and whose brain, open to all manifestations of thought, has continued its evolution in the direction of perfectibility. Military life in

France has exercised, and perhaps still exercises, a prejudicial action on the mental faculties. How many amongst us have not known young Officers full of promise, with a quick intelligence, and warm heart, who have foundered in the glass of absinthe, or who have become passive beings, a kind of civilian in uniform, amongst whom the spirit is timid, contracted, and stunted. To what cause is this due; if not to the system of education and instruction which is applied to our young Officers? Instead of stimulating the judgment and reflective powers of these intelligent, but inexperienced youngsters, they are condemned to recite the prose, more than mediocre, of the regulations. Now this stupefying period is happily passed, and we have often verified, not without a feeling of patriotic joy, that the present Sub-Lieutenants know more about war after four years' service than our Captains after twenty."

"It is not so much the military instruction that is needed for our young Officers as military education in a practical sense. The aim of all Officers of the higher ranks should tend towards developing the hearts and judgment of the Officers below them. This object can be attained by two means; the first consists in requiring from all young Officers the greatest zeal in the execution of their duties; the second lies in a concrete form of instruction. It is necessary after having given an Officer a mission to fulfil, whether fictitious or real, to let him act, to leave him completely to himself, while watching his acts and movements, without interfering in the least degree in the world. The mission ended it is desirable at once to ask questions, and to rectify mistakes."

Instead of the attack and defence of a position, which is the usual theme set to Officers to work out, the author suggests the following plan:—

"A general idea forms the basis of a series of exercises; each exercise has a special subject, on the supposition that one belongs now to one side, now to the side opposed. The commander of the battalion directs the first exercises, in the sense that he issues his orders, allots the troops and the special missions. Each Officer, who is given some employment or a mission, goes to examine the ground on which he will have to act, takes notes of the dispositions he will adopt, and then returns to the commander of the battalion and makes his report, and hands him his notes. Afterwards the Officers, headed by the commander of the battalion, go and visit the sites which have been studied, and as soon as the group reaches a place which is included in the work of an Officer, this Officer gives the reasons which have influenced him in making such and such dispositions. The battalion commander approves or blames, basing his decision on reason and experience. After several of these exercises, the commander of the battalion sets a scheme, and a Captain is selected to detail the Officers and their missions to carry it out. The Captain thus chosen acts as the battalion commander has been shown to act; this latter restricts himself to rectifying the mistakes in the decision arrived at by the former, to giving to the exercise an intelligent impulse, and finally to making a *critique* on the whole, which ought to be instructive."

"The war game as practised in France has produced weariness and disdain in all the regiments that have tried it, due to the coarse and insufficient materials brought out by the *réunion des officiers*, and above all to the unfortunate notices which accompany it." The author in consequence advocates that the war game should be played on large-scale maps representing the ground surrounding the principal garrisons; the game could thus be utilized with the cadre exercises previously referred to.

"After these exercises the best means of training Officers consists in their writing an essay during the winter months. The subject should be selected by the commander of the battalion, according to the instruction, intelligence,

and experience of the Officer for whom it is intended. The Captains are too old for such work to be made obligatory on them ; but those amongst them who have new ideas on certain subjects of their own should be encouraged to set them forth in writing. The questions set to the Lieutenants and Sub-Lieutenants ought to be so chosen as to necessitate on their part a hard labour of reflection and adaptation. The person who sets the essay for the winter ought to indicate the original authors who may be consulted by the Officer, and if the latter discovers some documents unknown to the commander of the battalion, or not mentioned by him, it is the duty of the Officer if he utilizes them to insert their titles in the list of books he has consulted, which list is placed at the commencement of his work. If these essays are marginally noted by commanders of battalions, their return to their owners will afford a profitable lesson to them."

The theoretical instruction of the Officer further comprehends the practice of discussing some military subject before his brother Officers, and the author advocates the following plan :—"Each Lieutenant or Sub-Lieutenant should be obliged to prepare a subject of his own choosing for discussion amongst the Officers of his own rank in the battalion ; the commander of it, or a Captain chosen by the young debaters, would preside at the meeting. These debates should take place between the commencement of April and the end of July. Those Lieutenants who might have given an interesting lecture should be invited as an honorary reward to repeat it before the Officers of the regiment. Besides the above, a few regimental lectures should be reserved for the superior Officers and the Captains who may wish to bring forward a subject of present interest, or the result of their unpublished personal researches."

Conclusion.

"Our conclusion is, that the French infantry approaches the moment when the principal reforms in its life since the termination of Napoleonic wars will be accomplished. The emancipation of Captains and battalion commanders which will result from the autonomy given to the troops under their command will communicate a prodigious impulse to the already rapid course of military progress. Around them the infantry sees the cavalry, then the artillery, enter upon the path of autonomous squadrons and batteries ; its turn will not be much longer delayed, and this time it will not be a question of being deceived. We will say no more ; in principle the plan is adopted, but on account of this or that, it is carried out in quite a different manner, and the old and easy routine is followed. No ; it is absolutely necessary that our companies or battalions should live their own proper life. After some years of this system, we shall see our Officers and non-commissioned officers, now so depressed by the yoke of an antiquated interior economy, expand in all the brilliancy of moral, intellectual, and physical health."

"After the great reform of the interior economy, another one, not less important, that of the field exercises, is required. These regulations are double, that is to say, they contain drill evolutions which are executed on the barrack square, or on the manœuvre ground, independently of all idea of fighting, and fighting exercises applicable to war. For the former one could not do better than take up, while reducing them considerably, the sections devoted to the training of the subdivision and regiment in the Regulations of 1862. The latter, on the contrary, require quite different principles for their execution."

"If we have dealt, with a complacency more apparent than real, on the facts acquired in Germany by foreign Officers and ourselves, it must not be concluded that we possess an admiration without limits for the German Army. We have only stated that this Army is in advance of our own in modern

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military evolution. There is nothing discouraging in this fact, quite the contrary, if one reflects that, thanks to our powers of assimilation, we have in fifteen years made as much progress as the Prussians have taken fifty years to attain. Our ascensional march is rapid, while the German Army, from its very perfection, is condemned to immobility. We shall pass by our rivals in virtue of our swift impulsion, as Bonaparte left Frederick behind, by assimilating his genius and amalgamating with it all his own contingent gifts."

C. K. B.

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REGULATIONS FOR FIELD SERVICE IN THE GERMAN ARMY.¹

THE regulations hitherto in force relating to the special duties of the troops when on service, and their training in those duties during peace, date back to the year 1870. From the fact that it was not considered necessary to alter them during the long series of years that have since elapsed, it is evident that they were regarded as generally sound, and did not call for any radical alteration, such as was introduced into the fighting formations after the war of 1870-71. In certain points, however, modifications and additions have become necessary, and they are embodied in the new regulations, of which a portion was published last year as a provisional measure. The whole ground covered by the regulations in their complete form may be taken to include all the duties which troops in the field are called on to perform when halted or on the march, with the exception of the actual tactical formations for fighting purposes. And besides indicating the nature of these duties and the manner in which they are to be performed in the field, instructions are also given regarding the training in them of the troops during the annual peace manœuvres.

The regulations of 1887 are divided into two parts, of which the first treats exclusively of duties in the field, and the second consists of instructions for the autumn manœuvres. Under the former are included the *Ordre de Bataille* and distribution of the troops; the communication between those exercising command and the troops; reconnaissance; measures for the protection of the troops; the march; quartering of the troops; baggage; supply; the salitary service; the supply of ammunition; railways; telegraphs; and field gendarmerie.

The second part deals generally with the annual training of the troops in field duties by means of autumn manœuvres. This comprises the distribution of the time available under varying circumstances to drill by regiments and brigades, and to the more extended manœuvres; the conduct of manœuvres of one force against another, and of a force against a marked enemy, with various other details relating to peace manœuvres.

In the present paper the first part only will be dealt with, and that only so far as to include the quartering of the troops. The further subjects comprised in that part, together with the whole of the second part, will be reserved for future notice.

The work as a whole is well worth studying in its every detail; but for the purposes of the present *précis* much that is of interest to those who would go closely into every particular of the regulations must be restricted to a brief notice. In this paper the foregoing remark applies especially to the portions which treat of the communication between those exercising command and the troops, and of their quartering in cantonments or bivouac. In these sections much has been omitted, not because the subjects in themselves are wanting in importance, but rather on account of their being treated in the regulations in too detailed a manner for reproduction in a brief notice.

The sections dealing with the measures to be taken by the troops for their protection, whether on the march or when halted, have on the other hand been

¹ "Felddienst-Ordnung," Berlin, 1887: Ernst Siegfried Mittler und Sohn; pp. 216; size, 6" x 4" x $\frac{1}{2}$ "; weight, 7 oz.; price, 2s.

reproduced at considerable length; and though by no means in every particular a literal translation, the more important paragraphs are so in substance.

In an introduction of some length the occasion is made use of to record the qualifications required from both Officers and men in time of war, if they are to be in a position to look forward to success with any feeling of confidence. The necessity for devoting from the outset of the military career the most careful attention to instruction and practice, in every particular, is dwelt upon with an earnestness which must make every Officer feel how important may be the bearing of details only too frequently regarded as trivial.

The position of the Officer is summed up in a very brief definition: he is the instructor and leader in every branch of the soldier's duties. As regards his own instruction, it follows that a high standard is required. Besides the regular experience learnt in the ordinary course of his duties by means of the periodical military training and manœuvres, the theoretical study of his profession is encouraged by means of participation in *Kriegs-spiel*, lectures, winter essays, and the working out of practical schemes on the ground.

H. H.

Communication between those in Command and the Troops.

Written orders should be the rule. Even if the order can be given verbally, as may be the case with assembled troops, long orders will be taken down to dictation. When it concerns only simple arrangements, or a single direction, an order may be given verbally. As a general rule, it should be borne in mind that an order must contain all the necessary information to allow of a subordinate carrying out what he has to do, without however containing further directions than are required for this purpose.

In sending orders or reports in the field they should be reduced to writing whenever time and circumstances will allow. If to be delivered verbally, the bearer of it must repeat the substance of the order aloud before riding off. Important orders and reports should, if possible, be sent by Officers.

In the case of particularly important ones, or if the communication is insecure, several orderlies may carry copies of the same order by different ways, or several may be sent in company.

When great distances have to be covered, and at night, it may be desirable to despatch with the Officer a party of infantry in carriages.

Frequently, and especially when the written paper is to be destroyed if the enemy are likely to seize it, it is prudent to make the bearer acquainted with its contents.

Reconnaissance.

The duty of covering the front of its own army and gaining information regarding the enemy's position and movements is almost entirely undertaken by the cavalry. In a restricted sphere, the divisional cavalry provide for the security of the troops to which they are attached from surprise, especially on the flanks, when they are engaged. The duties of the cavalry when so employed are not restricted to simple observation alone. No possible sources of information are to be neglected; the inhabitants must be examined, prisoners taken when practicable for a similar purpose, newspapers, letters, and other available correspondence carefully investigated for any information that may prove useful.

Though, in order to attain its object, it may become necessary for the covering cavalry to engage the enemy, the main purpose to be kept in view by them is observation. For this purpose small bodies are best adapted, and Officers'

patrols, composed of subdivisions or squadrons under selected Officers, are usually employed. This allows of small patrols belonging to the enemy being overpowered, and of orderlies being sent back with reports, as occasion requires. Where circumstances necessitate it, the bulk of the patrol will be left behind, concealed from the view of the enemy's advanced troops, while the Officer, accompanied by one of the best mounted men, goes forward to reconnoitre.

Every independent cavalry leader, down to the squadron commander, and even the Officers' patrols, is responsible that the touch obtained of the enemy is not lost.

Measures of Security.

General Considerations.—In the vicinity of the enemy every body of troops requires to be specially guarded. The portion of the troops told off to do this has for its object to protect the whole force from surprise, to afford sufficient time to enable the commander to issue his orders, and to allow of their being carried out.

The division of the troops may be made in different ways; but it is based always on the same principle, that the larger bodies push forward smaller detachments of a strength depending on that of the whole body employed. Whereas a large force pushes forward several bodies of troops, one behind the other, becoming smaller as they approach the enemy, to protect it, a smaller force can restrict its measures of security to the smallest possible detachments, provided it is itself disposed as the protecting body of a greater force.

On the March.—Measures of security are required on the march, because being tied to the roads necessitates a great extension in depth, and consequently demands a certain time for deployment. The troops told off to cover the march have also the task of obviating slight disturbances, in order that the march of the whole column may not be interrupted unnecessarily. In the main a good reconnaissance service is the first step to security; still its completion by means of immediate measures of protection must not be dispensed with. The main body of advancing troops has its march covered by its "advanced guard;" the main body of retiring troops by its "rear guard." The protection of the flanks is effected by "flank detachments."

The Advanced Guard.

Although cavalry divisions in front provide in some degree for the security of the troops following, and form in a more extended sense their advanced guards, still the separation from the main body of a special advanced guard must not be neglected. Its strength and disposition are dependent upon the nature of the ground and the strength of the force—in large bodies upon that of the advanced portion. It consists of about one-sixth to one-third of the infantry, and sufficient cavalry. Artillery will be attached as required.

Pioneers will generally be attached to it, to remove obstacles or perform any other technical work; if the construction of a bridge appears likely to be required, a bridge-train is also attached to the advanced guard. If an engagement is foreseen, part of a sanitary detachment is also allotted to it.

The interval between the advanced guard and the main body is dependent upon the ground, its own intentions and strength, and the considerations regarding the enemy. On the one hand it must be sufficient to secure as far as possible the march of the main body from interruption, and on the other it must be no greater than to allow of the main body supporting the advanced guard at the proper time. In an advance having the offensive in

view the distance can be restricted so as not to delay the deployment to the front.

The advanced guard is divided into the main body, the advanced body, and the advanced guard cavalry. How far under cover of the cavalry a special distribution of the advanced guard can be made, depends upon circumstances.

The main body comprises the bulk of the infantry of the advanced guard, and also the artillery, if this forms a part of it.

The advanced body consists of from one-fourth to one-third of the infantry of the advanced guard, the necessary cavalry and pioneers, preserving as far as possible units intact.

The cavalry attached to it furnishes the detached party or point, and provides the necessary patrols. The advanced body marches so far in advance of the main body that it can secure for it in case of contact with the enemy the necessary time to form up, ordinarily a quarter to half a mile; with small advanced guards a sufficient distance to prevent the main body being surprised by effective rifle-fire.

The point, if possible led by an Officer, otherwise by a non-commissioned officer, with four to six men, moves at an average distance of from 300—400 paces in front of the advanced body. As a rule its leader, leaving one or two men on the road, utilizes the elevations in its vicinity to obtain an extended view, and makes up the distance again by increasing his pace. The men ride with their carbines on the hip, only in covered ground with them slung. In the dark or in thickly covered country the cavalry point can be reinforced or relieved by infantry. An infantry point consists of an Officer with a section, so as to offer some resistance and be able to spread out and examine a greater breadth of ground without having to fall upon the advanced body. The infantry point moves as a rule in a skirmishing line, two men being ordinarily placed midway from the advanced body as a communicating file.

Infantry marching alone forms its advanced guard in a similar manner. Cavalry divisions do so also, but their functions exclude any definite forms being adhered to, and the same applies to cavalry bodies marching alone.

Every measure taken by an advanced guard must aim at securing the steady and continuous march of the whole force from being unnecessarily interrupted. The essential thing is to protect the troops from unexpected serious attacks. Small bodies of the enemy are endangered by the leader of the advanced guard feeling that he has during the advance the main body of the force behind him and can act energetically.

Flanking Detachments.

Where it is necessary to cover an extended front, especially on more than one road, so that the power of resistance of the advanced or rear guard cavalry is not sufficient, a flanking detachment is furnished from the main or advanced body, and disposed in the same manner as the latter. If this measure should not be found sufficient for the protection of the flank of the main force—especially in flank marches—it will be advisable to send out a flank detachment from this force also. Its strength and composition are dependent upon the degree of the danger and on the ground.

In flank marches this protection is often provided for best by leaving the existing advanced or rear guard to form the flank detachment intact and furnishing a fresh advanced or rear guard from the main force.

Cavalry marching alone or, in exceptional cases in the vicinity of the enemy, infantry alone, take similar steps for the protection of their flank.

The Rear Guard.

Whereas the advanced guard can reckon upon early support by the main force, the contrary is the case with the rear guard. The latter should consequently choose its ground for an action, and by occupying positions with obstacles in front force the enemy to deployments which will gain time, or if possible to make *détours*. In case of extremity the rear guard must not shrink from a tenacious resistance, and its composition must be arranged beforehand with this in view. It must in consequence be much stronger than an advanced guard, particularly in artillery, as the employment of this arm alone allows of the enemy being forced to deploy at a distance. Horse artillery is particularly suited for this service.

The distribution of a rear guard is ruled by the nearness and the attitude of the enemy. If not forced by these considerations to march in fighting formation, the rear guard moves in column of march. Its distance from the main force is on an average greater than that of the advanced guard, so as to allow of any delays in the march. The formation on the march is in a main body, a rear body, and the rear guard cavalry, composed in the same manner as the equivalent portions of the advanced guard. In order to preserve touch of the enemy, the rear guard cavalry remains a sufficient distance back; and if the enemy pushes the retirement, it must specially watch any attempt to gain the flanks. Care must always be taken in forming a front to the enemy that too weak a force is not placed in the front line.

If time admits, preparations should be made to delay the enemy by means of blocking the roads, destroying bridges, and measures of a like nature. These works will be more thoroughly executed if the pioneers or infantry detailed for the purpose can be carried in wagons. Infantry or cavalry marching alone form their rear guard in a similar manner.

Mixed Outposts.

The first step towards obtaining security is by an active endeavour to gain intelligence of the enemy, and the nearer the enemy is, the greater becomes the necessity for this. If the necessary protection is not afforded by independent cavalry pushed forward, mixed outposts are the rule, the two arms taking their share of the duties in such a manner that the cavalry undertakes principally the reconnoitring and day duties, and the infantry principally those by night. Their strength depends upon the attitude of the enemy, the strength of the main force and the nature of the ground, and their disposition upon the length of time they are to be in position and the time available. A prolonged halt in face of the enemy necessitates a more perfected disposition, while troops that halt after a march, with the intention of moving off again in the morning, must be contented with the simplest measures. Whereas, therefore, fortress warfare demands a systematic division of the outposts, and especially a rigid advanced line, in the field the forms are elastic and are adapted to the changing circumstances.

By day and even more by night the movements of troops before and after an action are restricted to the roads. It follows that the roads should be occupied which lead towards the enemy. If these are seized, the enemy's more considerable movements cannot take place undetected; smaller ones off the roads may disturb the outposts, but they will not endanger the main force. Whereas, after the close of an action, the outposts will preferably be formed from intact troops, after a march the advanced or rear guard undertakes the duty of covering the force and placing the outposts without further orders. As a rule the main body of the guard halts where it is, and the advance or rear body forms the outposts at the halt.

The advanced or rear guard consists for the period of the halt of the main body, with which is the commander, and of the outposts. If there are in front of the outpost line localities or points to be specially occupied for the protection of the whole, this can according to their respective positions be advantageously done from the main body. These detachments are then constituted as a portion of the outposts. If the posting of the outposts requires, on account of the vicinity of the enemy, to be covered, the advance or rear body may be temporarily halted, and the outposts thrown out from the main body covered by the former. Whereas this is an exception, on continuing the march it is an appropriate rule to leave the outposts in position and move the new advance body out under their cover.

The outposts are divided into a main body, the outpost companies, and the outpost cavalry. The main body forms, as a rule near the main road and behind a defensible position, the first support of the advanced companies. These companies form the main protecting line, being placed as far as possible in ground offering facilities for a tenacious defence in case of attack. They protect themselves by pushing forward infantry pickets and non-commissioned posts at night, and if necessary in the daytime as well. According to the local circumstances the main body of the outposts may also send these out direct to its front or flank. The outpost cavalry is in the front line by day, taking over the duties of covering the force and having its first support in the companies. At night, a portion of it may remain with the advanced line.

It will only be advisable to attach artillery to the outposts under very exceptional circumstances. If so employed by day it goes back to the main body of the outposts at night.

Mounted orderlies will be attached at the rate of from four to six to the main body and to each company, and one or two to every infantry picket. The whole of the outposts are under the charge of the outpost commander, who is as a rule the commander of the advanced body.

When the conformation of the ground, readiness for action, or the extent of the front require a division of the outpost line, two or if necessary more outpost sections may be formed adjoining one another. In this case each of these sections is allotted as far as possible to one battalion, or the portion of it belonging to the outposts, which then forms within the section its own main body and outpost companies, receives its own cavalry, and is under its special commander.

From the diversity of circumstances, of the object in view, and of the ground, *no instructions can be given for outposts which will meet all contingencies. In each individual case the distribution, orders, and duties of the outposts must be regulated according to the special circumstances.*

On the order to halt at the latest, the commander of the advanced guard indicates the position for the night of its main body, and receives information of the main body of the outposts, and other directions as to what he has to do. He then draws up, by the help of the map, his advanced guard order.

This comprises :—

According to the circumstances he will state more or less distinctly the considerations, a knowledge of which will be required by the outpost commander to enable him to make his arrangements promptly ;

Information regarding the general situation, the enemy, the position of the main bodies of the force, and of the advanced guard ;

Detail of the outpost commander, and the troops to be placed under him ; the task intrusted to him, and the other instructions necessary to allow of his carrying it out (what the outposts are to do if attacked by the enemy, what localities are to be more particularly held, what points should be more especially watched, &c.).

If the formation of several sections is necessary, the boundaries of these must be fixed.

At the same time orders should be issued for the troops not detailed for the outposts, and directions as to what special detail is to be made from the main body of the advanced guard in the vicinity of the outposts; and further, where the commander of the advanced guard will be found.

The Outpost Commander.

In order to avoid loss of time and going out of the way in placing the outposts, the commander will then by the aid of his map give his outpost order, as a rule while marching:—

This will comprise, broadly, the directions required to ensure the judicious arrangement of the outposts being quickly carried into effect.

The following points are essential:

Indications regarding the general situation, the enemy, the situation of the main force and the main body of the advanced guard;

Indication of the general line to be taken up by the outpost cavalry, as well as of the roads which are to be watched by it;

The position of the main body of the outposts, and where the outpost commander will be; the division of the sections for the outpost companies;

Allotment of mounted orderlies; and of the cavalry to be attached to the infantry;

Directions as to the procedure if attacked by the enemy;

To these are generally added the indication of the roads to be occupied by examining parties, the means of security to be provided direct from the main body of the outposts, the time for the retirement of the cavalry in the evening to the main body of the outposts; as well as directions for the night.

Other measures, such as blocking roads, and the special conduct of individual formations, &c.

On receiving the order each portion marches by the nearest way to the place assigned for it. The commander of the outposts further instructs his main body regarding the provision to be made for its shelter, the degree of readiness to be maintained, and the necessary measures for its own protection. Though, after the outposts have been placed, the presence of the commander may be necessary with the advanced line for the purpose of gaining information and controlling the position, still he must not overlook the fact that his duty of commanding the whole of the outposts requires his presence with the main body of them, to which all reports are sent and from which orders are awaited. If he should go to the front, he must hand over the command of the main body to the next senior Officer, who for this reason must be made well acquainted with the situation.

The bivouac or locality where the commander is quartered must be fixed so as to be easily found, and buglers and mounted orderlies must always be at hand. The outpost companies and cavalry as soon as they have got into their positions report upon these in the form of a simple sketch, which is sent to the commander of the advanced guard.

The Main Body of the Outposts.

The general situation, especially the nearness of the enemy, will rule the degree of readiness in which the main body must be kept. Infantry keep on their accoutrements, artillery must not be unharnessed, and their guns, which should be kept as far as possible close to the road, must never be placed in closed farm buildings.

The commander decides whether the main body is to be wholly or partially

in bivouac, or under cover in available buildings ; if the whole, or a portion at a time, is to cook, and horses be fed, and if the latter are to be unsaddled by detachments or only the girths loosed.

The main body protects itself by exterior guards. Except in case of alarm no calls are to be sounded or signals made. If the alarm be given in the front line, the main body gets under arms, ready to take the offensive or assume the defensive.

The Outpost Companies.

The number and position of these companies depend upon the ground, and especially the disposition of the roads. A company placed on the main road or in its vicinity is generally the weakest in the line. The companies will not be numbered as outpost companies, but designated by their ordinary numbers. Their distance from the main body must afford it the necessary time to form up ; if a company occupies a particularly important point, or one specially favoured by the ground, the most determined resistance will be provided for there, and it will be supported from the main body.

The commander moves out in front of his advancing company and rapidly examines the ground, with a view to deciding where it is to be placed, and what parties it will have to send out for its protection. According to the nature of the ground, and especially the roads, pickets or non-commissioned officers' posts, or both, may be necessary.

The protection of important roads and points is provided for in principle by pickets ; independent non-commissioned officers' posts assist towards establishing connection and the security of the flanks.

All portions must, by their situation, be hidden as much as practicable from the enemy's view.

The posts pushed forward direct from the company, which in addition to the required number of men for reliefs have generally a few for patrolling duties, have on a small scale the same duties to perform as the pickets, so that their conduct is ruled by like principles. The pickets and posts within the company are numbered from the right, irrespective of whether they are pickets or posts. Whether one or other of the pickets should remain out by day depends essentially upon the ground, and whether this is so covered that the cavalry alone cannot ensure adequate protection.

The men of the outpost companies fall out, but a portion must always be in readiness, in the vicinity of the rifles and packs. No one must leave the company without orders. The mounted orderlies must not unsaddle, and only loosen the girths of their horses, and water and feed them singly. The company posts a single sentry, or if in a building, a double sentry over the arms ; in particularly covered country, further double sentries may be placed for its immediate security.

The company commander is responsible for the position and duties of every portion of his company.

All further measures for the conduct of the company, whether the whole or a part should be placed under cover, the supply of water, requisitions for completing provisions, cooking, whether for the whole at one time or by relays, the wearing of greatcoats, &c., will all be regulated by the company commander, according to the actual circumstances, and he will be personally responsible that *in the event of attack the company shall be at all times in a complete state of readiness for action.*

He reports as early as possible to the commander of the outposts the position taken up and the arrangements for the night, by means of a simple sketch with the necessary explanations. The neighbouring companies and the cavalry in front are to be informed of the position of the company.

The Infantry Pickets.

The strength of a picket is ordinarily a subdivision or a half subdivision. The time for marching off must be so arranged that they are able, after reconnoitring the ground, to take up their positions before dusk. In placing the advanced posts, less regard is had to forming a connected chain than to the occupation of the roads and paths by which the enemy might advance, the intervening ground being searched by a regular patrol service. The number and position of the posts is decided by the Officer on guard; each post will be formed either by a double sentry or a non-commissioned officer's post. To allow of their fulfilling their object of seeing well in front, they are placed in the day as well as by night on heights in covered positions.

Those which are particularly important or exposed, as well as the examining posts, are furnished by non-commissioned officers' parties of six men, of whom two are on sentry and the rest form reliefs and remain in the immediate vicinity. The double sentries furnished by the pickets should not ordinarily be at a greater distance than 500 paces. As a rule, in placing the sentries, the six men told off for the post are marched direct to it from the picket by a non-commissioned officer, who, after posting the first relief, marches back the other two reliefs, who in this manner obtain a knowledge of the ground. If the number and position of the sentries cannot be decided upon beforehand, they are posted successively. The posts whether non-commissioned officers' or double sentries are numbered from the right. If the outpost cavalry does not suffice to cover the placing of the posts, infantry patrols are sent out for the purpose; the remainder of the picket piles arms, and a single sentry is posted over them.

On the return of the picket commander he forms patrols, and sees the piles of arms arranged, so that the reliefs and patrols can take their rifles without disturbing the rest of the men. He reports to any superior Officer, but the men do not stand to their arms. Packs and the back pouches are taken off, but the rest of the accoutrements, with the front pouches, haversack, water-bottle, and intrenching tool, are kept on. The mounted orderlies must only water and feed their horses singly.

The commander of the picket is personally responsible that *in case of attack the picket shall at all times be ready for action.*

All persons brought to the examining party who are not clearly recognized by the commander of the picket as belonging to the force, will be handed over to the company. If the picket be posted during the day, the commander must examine the ground within his section, so as to be ready for the requirements at night; but he must always be easily found if wanted. At night he always remains with the picket.

The commander of the picket reports the position he has taken up as early as possible to the company commander.

Sentries.

The following general instructions apply to all sentries in the advanced line:—

They must look out continuously in the direction of the enemy, and pay attention to every suspicious sign.

They must not lie or sit down without orders, or let their rifles out of their hands.

The moment anything is ascertained regarding the enemy, one man reports it to the picket or company.

If there is danger in delaying, or an attack is recognized, several shots are to be fired, and one man reports the cause.

During the day the persons recognized as undoubtedly belonging to the force may be passed through the line of sentries. All others will be directed to the examining parties. At night every one approaching will be challenged, and the rifle brought to the ready. Any one not halting on a second challenge will be fired at. If recognized on halting as belonging to the force they will be passed through. All other persons will not be allowed to pass, but will be directed to the examining posts. Any one not going there direct, but trying again to pass, or not attending to the orders of the sentries, will be fired at.

Individual Officers with a small escort coming from the enemy with a white flag or handkerchief, or sounding a call at a distance, and individual soldiers recognized as deserters by their throwing away or reversing their arms, will not be treated as enemies, but will be directed to the examining posts. No sentries salute, nor are they to be interrupted in their look-out by the presence of superior Officers; they only answer any questions addressed to them.

On relief the men of the double post place themselves side by side fronting the enemy, and give over their orders.

These general instructions are completed when the sentries are posted by certain special instructions given by the picket commander; these are:—

The denomination of the post; the situation, the position, and denomination of the neighbouring posts; situation of the examining party, the picket, and the company, and the nearest way to them.

Information regarding the ground, so far as this comes into consideration and is within the man's understanding. If the sentries are to stand with the rifle carried on the arm, ordered, or slung.

If the communication will be kept up with the neighbouring posts by means of patrols.

If the pack may be taken off, and if smoking is permissible, together with any orders necessitated by the special circumstances.

The picket commander determines in each case whether the reliefs of the non-commissioned officers' posts may be placed under cover, and the measures of security to be taken by them. The examining post allows all those evidently belonging to the force to pass through, and conducts others to the picket or company. Bearers of flags of truce are blindfolded and deserters disarmed before being sent back.

Patrols.

The arrangement of the patrolling service has to be settled from the point of view that no break must occur in the system of gaining information.

The value of every patrol increases with the nearness to the enemy and the promptitude of its report. *Accordingly, under all circumstances by night as well as by day, cavalry patrols must be sent out.*

The cavalry patrols will be completed at an appropriate distance by infantry patrols. The conduct and instruction of these will differ according as they are intended to go beyond the line of sentries or not, and are consequently meant more or less to come into contact with the enemy.

The selection of the patrols to be sent beyond the line of sentries towards the enemy is of particular importance. These patrols are composed of not less than two men under a skilful leader, on important occasions an Officer; and their object will be obtained less by careful instructions than by the choice of the men, and especially of the leader. The knack of finding the way quickly in strange ground; endurance, such as can only be attained by having their heart in the work; presence of mind and cunning, having in the moment of danger always some expedient to resort to for escape, are the desired

qualifications for this service. The patrols move circumspectly and without noise; frequently halting to listen. They study the ground as much as possible, so as to report on it, and, if necessary, act as guides; they avoid fighting and being cut off by the choice of a different way to return. They should be sent out without packs and in forage-caps, and the hour for their return fixed.

Patrols of two men within the line of sentries are sent out from time to time to visit the sentries, examine the ground not occupied, and communicate between the sentries. In the event of firing or alarm, a patrol is sent out at once to obtain information and afford a first support.

The relief of the pickets is best effected about daybreak, and is carried out as quietly as possible, covered by patrols from both the old and new pickets. The new picket marches up to the old one, and both commanders proceed to carry out the relief of the posts and sentries.

All patrols, when they cross the line of sentries, must inform the neighbouring posts in what direction they are going, and, on their return, what they may have observed of the enemy.

The Outpost Cavalry.

The strength of the outpost cavalry must be adapted to the work of covering the whole breadth of the front well in advance. The practice of bringing the cavalry back at night allows of the same squadrons being more frequently attached to the outposts than can be the case with battalions of infantry. Generally speaking, the proportion is one squadron to every battalion, and it is desirable to keep squadrons intact. The first duty of the commander of the outpost cavalry is to maintain or establish touch of the enemy, or if at too great a distance, to move out well in advance and observe the ground in front.

He must decide promptly upon the measures to be adopted, so as to arrange for the roads specified in the outpost order being watched. In covered ground breaking-up can be avoided less than in open country. Though the weak strength of the body remaining behind in close formation will hardly admit of the power to attack, still a skilful occupation and command of points which must be passed by the enemy in a sudden attack will ensure his being materially delayed by carbine fire.

The distribution of outpost cavalry depends upon the circumstances, and it may consist in the posting of one or more pickets, or only of non-commissioned officers' posts, or both, to the front and flanks. The distance from the outpost companies in rear will be sufficient to allow of timely notice being given them of any threatening danger. The outpost pickets must not unsaddle, but only loosen the girths, feed and water by reliefs. It depends upon the more or less threatening state of affairs whether the whole or a portion may be placed under cover, which depends also on the condition that the horses can be brought out quickly. The occupation of quarters necessitates the sentry on the arms being doubled. It depends, amongst other things, upon the duration in the position whether fires are to be lighted and rations cooked.

The commander is personally responsible for all these points, and also that *an attack shall always find his troops ready for action*. He reports his position to the commander of the outposts as early as possible. This report, if practicable in the form of a simple sketch with the necessary explanations, is sent in the first instance to the outpost companies for their information. The company commanders must further obtain from the leader of the cavalry information regarding their positions, and *vice versâ*, communication being established between them.

The strength of a picket will be about one Officer and a subdivision. *A cavalry picket must never be placed in a closed space.* It posts a single dismounted sentry on the arms. The commander goes out to his advanced line to inspect the vedettes and non-commissioned officers' posts, if anything suspicious is reported, or if firing takes place, so as to see for himself without delay what is going on.

While he remains with the picket he reports to any superior Officer who may come to it. He always keeps some patrols ready, and sees that the whole of the picket are made acquainted with the ground, especially with the nearest way to their own squadron, the closest outpost company, and the main body of the outposts.

All other measures for the conduct of the picket will be regulated by its commander, and he will be personally responsible *that an attack shall always find the picket ready for action, and that by means of early intelligence the infantry in rear shall always have time to meet an attack.*

A section of ground will be entrusted to each picket. To watch this, and also to protect the picket, the commander places one or more non-commissioned officers' posts or vedettes, or both. The number and position of these are dependent on the following considerations: an extended view, and the power of seeing the neighbouring posts or sentries; when this cannot be effected without great extension, the roads will be occupied and the communication completed between the posts and sentries by means of patrols. Rapid communication is desirable with the pickets.

The non-commissioned officers' posts, of four or more men, will as a rule be all dismounted, and at most two men will be employed to keep a look-out. And further, the sentry even being dismounted and the rest of the men kept out of sight, the whole of the post is easily concealed from the enemy. Patrols from these posts will not be sent out to any great distance.

The roads specified in the outpost order, so far as these lie within the sphere of the outpost cavalry, will be occupied even by day by examining posts, notwithstanding that the infantry place their own for the night further back.

The vedette always consists of two or three men, of whom at least one must be mounted. They are relieved as may be decided by the commander of the picket. The advantage they offer is that owing to their small size the picket is less weakened by their withdrawal from it than by non-commissioned officers' posts. So far as in the foregoing special rules are not given for non-commissioned officers' posts and vedettes, the principles laid down for infantry will be followed.

When the cavalry pickets are placed, they are allotted definite patrolling duties by the outpost commander. A more extended examination of the ground is provided for by the commander of the outpost cavalry or the superior commanders.

Under all circumstances the cavalry even at night must keep touch of the enemy by means of patrols. With this object it may be advantageous to push forward stronger posts under Officers beyond the outpost line, not locally attached, which attach themselves to the enemy's movements.

The outpost cavalry must maintain constant communication with the infantry in rear. The pickets and independent posts must acquaint especially the neighbouring infantry without delay with any important information.

Outposts of Independent Infantry.

The outposts of infantry, provided only with mounted orderlies, will be distributed in the same manner and on similar principles as mixed outposts. In order to make up in some degree for the absence of cavalry, the infantry

pickets will be placed from the outset, and the mounted orderlies of the companies employed in more extended patrolling duties, especially during the day. If no mounted orderlies are attached, their place must be taken as far as possible by infantry patrols within a more restricted sphere.

Outposts of the Cavalry Divisions and other Independent Cavalry.

The work of the cavalry divisions or other independent cavalry must, even when halted and resting, be carried out by the cavalry alone, independent of the other arms. The great extension which the task of great masses of cavalry frequently demands will often prevent it from assembling for the night within a small area, or arranging a connected outpost system. It will generally happen that each place occupied by it, each bivouac, &c., is protected by its own outposts, and these will, according to circumstances, vary very much in their strength and distribution.

The close proximity of the enemy and a hostile population demand from the cavalry constant and wearing duties, for these will not be restricted to placing outposts, but special measures of security will frequently be required in the halting places. Whilst the power of reconnoitring far to the front is a protection against the enemy's infantry, an energetically advancing cavalry will not long be kept in check if there be nothing beyond the attack to oppose to them. On the other hand, blocked roads, barricades, &c., even of the simplest form, protected by carbine fire, will delay large forces of cavalry for a long time, if they be disposed several in front of one another at places by which an attack must pass. In doing this it should not be left out of consideration that the means of advance must not be altogether unprovided for. The pioneer detachments of the cavalry divisions will be usefully employed in connection with this service. Here and there they may also be utilized to occupy specially important points, notwithstanding their weak effective.

If the outposts have occupied favourable localities or positions, their defence by means of dismounted men will be of more use to the security of the whole than the immediate abandonment of them for the purpose of assembling. The outpost order must provide for this.

If the circumstances allow of the cavalry being kept together, the composition and disposition of the outposts, as in the case of mixed outposts, will consist of a main body and outpost squadrons, from which the necessary pickets and independent posts will be pushed forward. As far as practicable definite objects will be prescribed for the patrolling service of each body. The same principles also will apply as in the case of mixed outposts.

If the cavalry division is widely extended, as for example by brigades side by side, the outposts of the several groups will generally consist only of squadrons, with the necessary pickets and posts sent out. Besides the placing of regular outposts, at a distance from the enemy, advanced squadrons furnish an effective means of protection and gaining information. Free in their movements, they attach themselves to the enemy's movements, and on this account are best enabled to provide for their own requirements. Besides, they can offer effective resistance to attack, and cause delay by the occupation of important points lying well in advance of the outposts, such as bridges, defiles, &c.

Outposts in Fortress Warfare.

The Attack.—In operations of this nature the object of the outposts is not limited, as it is in the open field, to gaining time for the main force they cover to prepare for action, but extends further to the protection of valuable

and not easily moved material, as well as to the complete shutting in of the enemy's garrison.

At the commencement of the investment, and in some portions of the ground throughout the operations, the employment of cavalry outposts will suffice. With the further course of the attack, mixed outposts will frequently be employed; whereas, especially in the ground over which the actual attack is to be conducted, the outpost service assumes a special stamp of its own, and falls entirely to the infantry.

On the front of attack from the first and for a long time in close contact with the enemy, which grows closer as the attack advances, the outposts are frequently exposed to artillery fire, often to rifle fire, and always to sudden attacks.

The outposts will differ from those employed in the field in forming a connected chain of posts, in having the other portions closer up and nearer to one another, and in a more complete preparation of the ground by means of cover, in a determined resistance, and in the necessity for more easy communications. The establishment of the attacking force in the line of investment demands the immediate preparation of special positions, the placing in a state of defence of localities, &c., so as to cover the material and meet sorties. The outpost line may be in advance of this line or partially in it, for the position of the former rests principally upon the fact that every foot of ground won is to be held.

In order to be at all times ready to oppose a sortie vigorously and methodically, it is of extreme importance that every portion of the outposts should be placed in the position in which it will fight. The entire line of investment is divided into sections, each containing its garrison. About one-third of the infantry, often more, forms under the outpost commander the outposts of the section. The outposts are divided into a main body and companies, which, as in the field, furnish the necessary pickets and posts. The main body and the companies will, as far as practicable, be placed in buildings, which will be prepared for ready egress and easy protection, and be placed in a state of defence. Communications will be prepared with the advanced portions, generally by breaking through walls, digging galleries, &c., in such a manner that though not always affording protection from the enemy's fire, they will be covered from view.

In the frequently covered ground through which the outpost line may run, as through villages, woods and gardens, it is of great importance that every portion of the outposts should know the ground well, so as to avoid confusion, especially at night. The degree of preparation of the whole must in general be more complete than in the field, while on the front of attack it must be still more perfect. The pickets, both for their protection and on account of the wearing nature of the outpost service, must be placed as much as possible under cover, measures being taken by increasing the number of the means of exit, or by widening existing ones to ensure being promptly ready for action.

Numerous and small pickets are preferable to fewer strong ones, as it is desirable, at least by day, that the chain of sentries should be visible from the pickets, and as it is less a matter of occupying the roads than of rapidly supporting the posts. The chain of posts consists, as in the field, of double sentries and non-commissioned officers' posts, and they must be so close together that no one shall be able to pass without being fired at. They will consequently have under certain circumstances to be increased in number at night. Cover must also be found or constructed for the posts; for the non-commissioned officers' posts, pits can be dug if necessary. The outpost commanders arrange specially that the outpost line restricts itself to the limits of its section and for communication with the neighbouring sections, and these points must be kept constantly in view.

The special instructions for the posts will direct an accurate knowledge of the ground, and call attention to the numerous different and changing aspects of the enemy which are to be particularly observed. Generally the rules given for the conduct of outposts in the field apply equally to those employed in sieges. It may sometimes be useful for the commander of the force to give a "parole." In this case anyone having been challenged and satisfying the sentry that he belongs to the force will be asked for the "parole," which should be given in a low voice. If not in possession of it, the person will be directed to the examining post; if giving a false word he will be fired at.

It must always be borne in mind when in close proximity to the enemy that any movement repeated at settled times will soon be known, so that generally regular relief will be exposed to artillery fire from the fortress. Too frequent relief is not necessary for the rest of the troops. The outpost companies will be relieved according to circumstances, and the entire outposts only after several days. In effecting the relief, care should be taken that as far as possible the troops occupy the sections they are already acquainted with.

The old outposts will not march off until the new ones are completely established and they have acquainted them with all the details and special instructions. Trifling oversights in this respect have often serious consequences. The quarters further back of the troops on outpost duties will not be occupied by other troops if it can be avoided. If circumstances permit, packs and helmets will be left behind in the quarters; but provisions and abundance of ammunition should always be taken. With the advance of the attack, the outposts assume the form of trench guards, pickets, and reserves, and take their place consequently amongst the troops employed in the actual attack, the duties of which are regulated by special principles.

The Defence.

Before the actual investment, the defenders will keep in view the importance of gaining intelligence regarding the advance of the enemy, and especially the intended establishment of the park. The support for the cavalry which is pushed far forward for this purpose, and for which, in the further course of the siege, there will be no equally important duty, is formed by the outer detachments, which fall back into the outpost position on the further advance of the attacking force. While similar circumstances to those of the attackers lead to a similar distribution and conduct of the outposts, the superiority must be made use of which an intimate knowledge and thorough preparation of the locality ensure. On a closer investment the same conditions apply to the outposts of the defenders as in the attack.

Conclusion.

The task of the outposts as a whole points to their not seeking to engage the enemy. A useless skirmish endangers the repose of the whole force, while it may lead to engagements, the limits of which it will be no longer in the power of the outposts to determine.

But an attack must always find the outposts in a complete state of preparation to put out their entire strength, and the leaders of every grade must be prepared for every sacrifice for the responsible object of covering the main force.

The March.

The far greater part of the efficiency of troops in war consists in their marching. The march forms the basis of all operations, and upon its certain execution essentially depends the result of every undertaking. It is often,

indeed, of decisive importance that a force shall arrive at the right time ready for action at the point indicated for it.

Strict discipline on the march, and the greatest care in seeing to the clothing and equipment, as well as to the feeding and health of man and horse, are the most efficient means of maintaining and increasing good marching capabilities. With the infantry it is the footsore men, and with the mounted arms the galled and lame horses, which weaken troops on a long march, and give the measure of the care devoted to the troops and of their discipline.

Constant observation of the infantry, the horses and the mounted men on the march, especially towards its termination, thorough control and appropriate alterations during halts as well as in quarters (especially on halting days), with strict punishment for neglect, are matters for the company and other commanders, and are alone capable of lessening the losses from the fatigues of the march.

Troops accustomed to discipline on the march will, however, only continue to be constantly and completely efficient if every exertion not absolutely demanded by the march be carefully avoided. In this connection, particular attention is necessary in regulating the times for the several units to march off. Large bodies collected at a rendezvous can only be put in motion successively. The arrival of the troops must be regulated accordingly, for waiting there only tires the troops unnecessarily. They must never march off earlier than is necessary, and the assembly of all the several units must always take place in the direction of the march. In framing the order for the march, therefore, the depth of the column, the rate of marching, and the distance from the rendezvous must be all taken into consideration.

The hour for marching must not be fixed too early. Even the advanced portions of the infantry will not ordinarily march off before daybreak, the mounted arms if possible an hour later, so far as their tactical employment does not require an earlier start. It is generally better not to march from a known locality before daybreak, than to arrive in an unknown one in the dark. All unnecessary *détours* are to be avoided. The marching off and in at the conclusion of the march takes place at "attention." Soon after marching off, on getting on to the road, the troops are allowed to march at "ease" in open order and out of step.

On broad roads, one side must be left sufficiently clear to allow of other troops passing; on narrow ones room must be left for mounted men to pass at speed, without delay or inconvenience to the marching troops. The mounted Officers with the latter must only use this free space exceptionally, especially with large columns. On bad roads or in hot weather it may be desirable for the troops to be divided and to march on either side of them, leaving the middle free. Individual changes in the uniform is not to be allowed; but any permissible relief in this respect is to be ordered for all at the proper time by the commanders.

The greatest enemy to the march is the heat, and the extreme fatigues it imposes on the troops, especially the infantry, the ranks of which it is capable of thinning in a short time, demand carefully considered remedies.

The most effective is regulated drinking during the march, without it being necessary to make a long halt for the purpose. By means of Officers sent on in front the inhabitants of the villages through which the column is to pass will be made to carry out water in as many vessels as are available to either side of the street, in readiness for the troops. With small bodies it will then be possible to allow all to drink by a short halt. If this is not possible, as with large bodies, without causing delay, the water should be handed to the men without halting, and they can drink and fill their water bottles. The disorder this may cause in the column will not lead to any slackening of discipline, so long as it is done by order.

Having the packs carried for the men affords them naturally considerable alleviation and increases their power of marching. But the great augmentation of the baggage inseparable from this measure limits resort being had to it to exceptional and minor occasions. In the formation for the march what is desirable is to unite sufficient looseness in the order to save the men's powers, with the necessity for placing bounds on the depth of the column, so as to allow of a rapid deployment for action. In the infantry, these conditions are best secured by marching in two ranks in section columns of four files, with an increased distance between the ranks. On the march, the company leader must see that supernumeraries, subdivision leaders, and non-commissioned officers march in ranks of four files at the front or rear of the subdivisions, and that musicians, sick attendants, &c., are at the rear of the company. He remains himself mounted, placing himself where his control is most wanted.

The diminishing of the depth by closing up the ranks soon increases the fatigue of marching, and is therefore only to be employed exceptionally and for short periods. A more permanent diminution, by increasing the front to subdivisions with half intervals will be permissible when the road does not become narrower frequently or for a long distance.

Cavalry moves in column of threes or of twos. The latter offers increased ease, but prolongs the depth considerably, so that with large bodies column of threes is the rule. The squadron commander rides where the control of the squadron can best be effected.

Artillery marches in single column with increased intervals between the guns. The battery commander is not restricted to his regulated place.

The impossibility of marching altogether at an even pace necessitates also, especially with large bodies, a greater extension of the whole column. This is provided for by intervals between the several units, which become closed up during temporary delays but are regained again subsequently. They are estimated as follows :—

After a company about 15 paces,	
" battalion, squadron, or battery, 30 paces,	
" regiment or division of artillery, 40 paces,	
" brigade, 80 paces,	
" division, 325 paces.	

The permanent extension of these intervals is no more allowable than a permanent contraction of them.

Besides the intervals care must be taken to maintain an even pace which avoids delays or marching out for the troops in rear, and for this the head of the column is responsible. Cavalry marches in front of infantry and now and then trots some distance. Under favourable circumstances large bodies cover a mile in about 20 minutes. It is a principle that the longer the column is the slower must be the pace maintained by its head. As a minimum rate on made roads and in moderate weather infantry marches 104 paces a minute, cavalry and artillery 103 at a walk, 260 at a trot.

Besides a brief halt shortly after the commencement of the march to allow the men to fall out, every march requires one or more rests according to its length and the temperature. A single one should be held after the greater part of the distance has been covered, and when there are several, every two hours afterwards. For every rest the arrangements must be so made that it is not shortened unnecessarily by movements that are avoidable. So as to fix upon a suitable place without halting, mounted Officers should be sent forward to look out for one. If other circumstances admit of it, and the road will not be blocked, the quickest method is to halt and pile arms or dismount in column of march on or close off the road. This need not

prevent individual units forming up in closer formation near the road. In choosing a place, the time of year and the weather are to be considered as regards shade, shelter from the wind or rain, &c.

Cooking during a march on account of the issue of provisions and getting fuel gives more trouble and takes more time than cooking in quarters or bivouac, where it has in any case to be repeated at the end of the march. Especially the want of water for cooking during the march may necessitate the troops forming up as completely as if going into bivouac. Unless in the case of an exceptionally long march, necessitating its division, and consequently cooking, it is more advisable to complete the march, even if it should not be done before late in the afternoon, and to combine cooking with the night's rest.

All the arrangements for the end of the march, as the direction of the several units by the nearest way to their quarters, the issue of billets, the moving into bivouac, &c., must, if practicable, be so far prepared during the march that every unnecessary delay in affording repose to the troops may be avoided.

All arrangements for the march are dependent upon whether contact with the enemy is possible. If this is excluded, the march allows, as a pure route-march, of regard being had exclusively to sparing the troops fatigue. The most essential point is to march in small bodies or separate units and by the shortest roads from quarter to quarter; for the larger and deeper the columns, the more frequent and sensible will be the interruptions, and the greater the dangers from the heat. The latter especially may cause a route-march to be conducted by breaking up the force and marching in the smallest units.

The moment contact with the enemy becomes possible, all other considerations give way to readiness for action. This lies in the collection of the troops in large tactical bodies, in the order of march, that is, the succession of the troops on the march, in closer order if necessary, and in measures of security being taken. It will then be for the commander to decide what must be done on tactical grounds and what to preserve the forces of the men.

The manner of concentrating the troops for the march is decided not only by tactical considerations, but also by the strength of the forces. Large rendezvous offer the advantage of disposing of the troops until the moment of moving off, of choosing between several directions for the march, and of arranging the order of march on the spot. They will, however, as a rule, only be adopted in close proximity to the enemy, which necessitates even during repose a close concentration. Otherwise, they entail waste of time in marching to the rendezvous, and a wearying conversion into column of march again.

If circumstances permit, formation in small groups is desirable in the rendezvous, as, for example, taking an infantry division, one for the advanced guard, one for the leading regiment of the main body and the artillery division, and a third for the other infantry brigade. These and smaller groups can also be assembled in column of march on the road. Baggage, ammunition columns, and train must never interfere with the movement of the troops. Large rendezvous, which cannot be recognized with certainty by the map, must be reconnoitred beforehand, and prepared if necessary by marking the edges of ditches with stakes, &c.

The order of march of the troops told off to protect the column (advanced guard, &c.) will be decided by their leader, that of the main body by the commander of the whole, in which the judicious employment of the troops is of first importance. As a rule, the infantry belonging to the same regiment or brigade as that with the advanced guard marches at the head of the main body, the artillery moves as far forward as its safety will permit; in regard to this it may be desirable with a very long artillery column to place a small

detachment of infantry in the middle of it. The bulk of the infantry follows.

A day's halt is desirable after a long series of marches, not only for the rest of men and horses, but still more by the necessity for putting the arms and clothing in order.

Night marches may sometimes be necessitated by considerations regarding the enemy, or exceptionally in the very hot season. They are always inseparable from the disadvantage of exhausting the powers of the troops. If they have to be adopted, special attention must be devoted to every arrangement that will secure the uninterrupted march in the right direction being maintained in the dark. The principal amongst these are to provide for the connection within the column, to avoid fatiguing delays by clearing away or moving round obstacles, and to follow the right road. In the vicinity of the enemy the strictest silence must be maintained.

Shelter for the Troops.

The German term covers what we understand generally by encampments, the difference in the expressions arising from the fact that the German Army does not carry tents. They trust entirely upon cantonments and the occupation of localities for cover on the march, resorting to bivouac only when these are not available. If the vicinity of the enemy, the numbers of the force, or the absence of large villages do not allow of accommodation in cantonments, the occupation of localities such as farms, and parks, gardens, &c., affords more shelter to the troops than simple bivouacs, while allowing the troops to be in an equal state of readiness.

In the immediate neighbourhood of the enemy, when tactical considerations necessitate the troops being maintained even at night in a special position, or in the absence of any shelter from localities, the simple bivouac is resorted to.

Cantonments.

If contact with the enemy is excluded, the comfort and supply of the troops is the main point, and they will be widely extended in the available quarters. The *ordre de bataille* forms the basis of the distribution, the mounted arms being divided amongst the others, so as to occupy quarters and stabling equally. On the march, the villages on and in the vicinity of the road will be more closely occupied. When in close proximity to the enemy, the troops must be kept together, and consequently the villages more closely occupied; the distribution will be ruled more by tactical considerations. The occupation will be closer, infantry will be strongly quartered in the places in the front line, the artillery more in the middle and never alone, and the cavalry further from the main road, the train being furthest from the enemy.

The headquarters and staff quarters will be as far as possible in the middle of their zones, near telegraph stations and large roads; care must also be taken that reports from the front as well as orders can reach them without going out of the way. When circumstances permit, the course pursued in peacetime regarding the preparation of cantonments will be adopted. With large bodies the distribution will be arranged with the civil authorities, and the quarters prepared by quartermasters sent on in front. Even when the distribution is only ordered actually during the march, quartermasters must be sent in advance, or in the infantry mounted Officers, if necessary, for it insures as a rule a more rapid settling down and earlier repose than if the troops arrive unannounced.

The issue of billets ensures regularity in getting into cantonments, and

this will consequently be always done when time admits of it. Otherwise, a more summary procedure must be adopted, whole quarters being allotted to the several bodies, and streets and houses to the units composing them.

The senior Officer of each cantonment acts as commandant. The Generals and regimental commanders are entitled to nominate the senior Field Officer. He arranges for the distribution of the several bodies, for their internal duties, the external measures for security, and the state of readiness of the troops. If regular preparations cannot be made for the distribution of the troops in the cantonments, this will be done by an Officer sent on in front, and it is desirable that he should be accompanied by the quartermasters. The several quarters must have limits that can be easily recognized, especially when closely occupied, regard being had to the alarm posts, and, if necessary, to the defence of the place. The artillery must always be in the vicinity of their gun-park.

A cantonment Officer of the day is detailed (with large cantonments a field Officer), and Officers for rounds will be detailed as required. Besides the cantonment Officer of the day, each battalion, cavalry regiment, and artillery division furnishes 1 Lieutenant, and each company, squadron, battery, and column, 1 non-commissioned officer of the day, for their respective units.

In each cantonment a main-guard will be established for internal duties. Its strength will depend upon the number of sentries required, which must be reduced to a minimum, especially when quartered during a march. Ordinarily, one on the colours and one on the wagons should suffice. If different bodies of troops occupy the same cantonment, each will furnish men to the main-guard according to the number of sentries it requires for its own protection. In order to economize the number, the wagons should be parked as far as possible together. Police considerations, an increased number of objects to be watched, the uncertain attitude of the inhabitants, &c., require an increased guard, and, if necessary, more than one. *The internal guards follow the procedure of ordinary garrison guards.*

In the neighbourhood of the enemy, special outlying guards are necessary, which are pushed forward according to the danger threatened and the ground. The issues as well as important points will be occupied by double sentries. With mixed arms they will as a rule be composed only of infantry.

The instructions for picket duties will apply to the outlying guards.

The alarm posts to be fixed for every corps must be selected near the respective quarters, in such a manner that they can be reached promptly from the points occupied by the troops, and that the several bodies shall not hinder one another. The alarm post of the artillery, which must always be by the gun-park, should as far as possible be situated on the side furthest from the enemy.

Under certain circumstances it may be useful to fix upon alarm rendezvous for large bodies, at which, on an alarm, regiments, brigades, &c., assemble without further orders. But it is advisable to limit this to those cases in which it can with some certainty be foreseen that the places of assembly selected are such as will meet the object in view.

On an alarm being given by the "Assembly" being sounded, the infantry form as quickly as possible, fully equipped, on their alarm posts. The dismounted artillerymen hasten to the gun-park and help the drivers to harness. The mounted arms, the baggage and carriages must, especially for night alarms, be given special instructions by the commandant. If the enemy should have got into the place by surprise, those who cannot reach their alarm posts remain in their quarters, so as to barricade them and prepare to defend them with their fire.

In the vicinity of the enemy, cavalry in cantonments by themselves will provide against surprise by precautionary measures. In the event of surprise their cantonment guards can be dismounted, and carbine fire employed.

The Occupation of Localities.

When large bodies are to be disposed in localities, they are divided between several situated as near as possible to one another, on the same principles as in cantonments, and the portions detailed that are to be quartered in houses and farms, and those that are to bivouac in the gardens, courtyards, and neighbouring fields. The roads must not under any circumstances be utilized for bivouacking.

If the whole are to be quartered in the localities the measures of security towards the enemy, as well as the internal duties, will be the same as when in close cantonments. If portions of the troops bivouac in the vicinity, these measures will be extended according to the orders in regard to bivouacs. The advantage offered by the occupation of localities with large bodies have also disadvantages which must be counteracted by various arrangements to be made by the commander. Amongst these are the difficulties of arranging in the dark for the regular disposition of the troops in them, of preventing unauthorized requisitions, of arranging the water supply and all those circumstances which are inseparable from the concentration of large bodies of troops.

It is of great importance, in arranging for the quarterings of large bodies of troops in localities, that the necessary dispositions should be made before the arrival of the troops. For this purpose it is desirable that the senior Officer should go forward, accompanied by an Officer from each corps.

Bivouacs.

The smaller the force and the less it is tied to a particular spot, the more advantageously can the bivouac adapt itself to the ground. The greater the mass of troops assembled in bivouac, the less can regard be had to choice of the ground. Respect for adjoining units leads to the limits of each unit being definitely fixed, and to the lines, the cooking trenches and the latrines, &c., being placed without special regard being had to the nature of the ground, the cover available, and the direction of the wind. The readiness of the troops for action also is not always ensured by the concentration of large bodies, for the difficulty of disposing the troops to meet an unexpected attack, especially in the dark, naturally increases with their bulk. When circumstances admit, therefore, it is advantageous to break up the larger formations into smaller groups for bivouacking purposes.

Apart from the troops detached for the purposes of security, advanced guards, &c., the *ordre de bataille* is followed. Artillery should always be joined to other troops. If large bodies must be assembled in a single bivouac, as large intervals as possible must be left, when the ground admits of it, between the different formations, both to facilitate interior order and to allow of the way about being more easily found in the dark.

The place of bivouac must be selected as early as practicable by the commander or his substitutes going on in front, and suit both as regards the tactical requirements and the comfort of the troops. The former influence the position and disposition of the bivouac, with a view to a rapid forming up or continuation of the march. If there is a question of the probable occupation of a position for defence, the bivouac must be situated only at such a distance behind this as will admit of it being occupied in time in case of sudden attack.

The bivouac must be withdrawn as far as possible from the enemy's view; good communications out of it must be considered and made if necessary.

The care of the troops requires, above everything, a sufficient and easy water supply, dry ground, and as much shelter as possible against wind and weather. Covered ground, such as standing crops, may be very inconvenient and is generally to be avoided. Meadows, although they appear to be quite dry, always harbour moisture and mist at night. One night passed on unwholesome, damp ground may cause more casualties than an engagement. Stubble or open wood offer, as a rule, the best ground.

The security, the internal arrangements, and the duties in bivouac are dependent upon the changing circumstances in regard to readiness for action, the care of the troops, and especially the nature of the ground. The following rules are (also in tents or hutments) of general application. The commander of the bivouac is responsible for arranging, according to circumstances, the appropriate measures, when a deviation from or addition to these becomes necessary. As regards the latter, he is responsible for obtaining whatever materials may be available (straw and planks for building huts, wood and underwood, &c.) to provide shelter for the troops from the weather as quickly as possible.

In the vicinity of the enemy, outlying guards are furnished to close the bivouac and protect it from attack.

The same rules generally apply to them as to the outlying guards furnished in cantonments.

Inlying guards serve principally for police duties; they are furnished from each unit according to the orders of its commander. Their strength depends upon the sentries to be posted, as a rule one on the commander and one on the colours for the arms.

The infantry bivouacs in company columns, which in battalion formation are side by side at 10 paces interval. The front of the battalion occupies 250 paces, and the depth of the bivouac about 264 paces.

The cavalry bivouac in squadron columns wheeled up to a flank, the squadrons at half distance. The front occupies 150 paces, and the depth of the bivouac about 320 paces.

The artillery bivouacs in such a manner that the guns are in front line, with 15 paces intervals; behind them come the carriages of the first relay (3 ammunition and 1 store wagon). Further, in rear and equally in two lines, with 15 paces interval, are placed the carriages of the second relay. Then come the horses, the men's equipment and packs, and after that the men themselves. A field battery occupies about 150 paces in front, and 220 in depth of bivouac. A horse artillery battery requires a similar front, but the depth is slightly greater.

In case of sudden alarm, whether from an unexpected attack, or if the "Assembly" and "Alarm" are sounded, the infantry (rifles and pioneers) hastens each man to his place by the arms, buckles on his equipment and pouches, and puts his helmet on. The putting on of the packs and unpling the arms follows on the command. The transport carriages are put to. The cavalry saddle as quickly as possible, put on their equipment and mount. The squadrons assemble at their alarm posts. The carriages will be put to.

Artillery (ammunition columns and train) saddle, harness, put on equipment, and put to the guns or carriages without further orders.

The inlying guards remain in their places until further orders or, if necessary, throw themselves on the enemy. The quarter-guards take charge of any material, &c., left behind, and in the case of a sudden march they only follow when everything is loaded up and ready to move.

As a rule the hour for breaking-up the bivouac will be previously ordered. In this case all fires will be carefully extinguished a quarter of an hour previously. The guards join their own corps—so far as this does not interfere with the continuance of the necessary precautions in the direction of the enemy—and the troops form up ready to march off. The whole of the carriages belonging to the troops remain in their places until they are ordered to move off.



ARTILLERY FIRE BY NIGHT.

An Account of Experimental Practice carried on in Russia by three batteries of the 14th Army Corps.

Translated from the "Russian Artillery Journal" of October, 1887, by
Major J. C. DALTON, R.A.

THE field batteries of the 14th Army Corps stationed at Brest-Litevsk were this year (1887) exercised in night firing, the range-finder of Major-General Martusheff being employed. The experiments were carried out on two separate occasions.

On the first occasion two light four-gun field batteries were employed; and on the second, one heavy eight-gun battery.¹

The first night's practice was on the 11th July, the instructions given to the two light batteries being as follows:—To advance unobserved up to within 2 versts (2,333 yards) of a supposed enemy's bivouac and open fire on it. The bivouac was marked out by targets representing two battalions of infantry, each occupying a square of 30 sajene (70 yards) side.² In the centre of each bivouac was suspended a common lantern containing one candle.

¹ The following details, taken from the official "Armed Strength of Russia," dated 1886, refer to the guns used on the occasions alluded to in this paper, and may be interesting to note in connection with the results of the experiments above described.

Details of gun, charge, projectiles, &c.	Light field battery. Pattern 1877, Steel.	Heavy field battery. Pattern 1877. Steel.
Calibre	3·42 inches.	4·2 inches.
Weight	9 cwt. 0 qr. 3 lb.	12 cwt. 1 qr. 0 lb.
Total length	82·5 inches.	82·5 inches.
Total length of bore	73 "	72 "
Number of grooves	24 "	24 "
Charge	2 lb. 15·8 oz.	4 lb. 1 oz.
Initial velocity	1,450 f.s.	1,200 f.s.
Common shell, weight, filled	15 lb. 2 oz.	27 lb. 8·6 oz.
" " bursting charge ..	7·2 oz.	14·4 oz.
Shrapnel shell, " filled	15 lb. 2 oz.	27 lb. 8·6 oz.
" " bursting charge ..	2·2 oz.	3·8 oz.
" number of bullets	190	300
" weight of each bullet....	0·42 oz.	0·42 oz.

² According to the original, each battalion is represented as occupying an area of 30 sajene (163·3 square yards). This appears impossible. It is unfortunate that there should be any doubt, because the dimensions of the targets are important for properly judging of the effect of the fire.—J. C. D.

Towards 9 P.M. both batteries had got to a village about 3 versts (3,500 yards) from the practice ground, and on the approach of darkness, having lighted their dark lanterns, they moved to their positions, concealing their advance.

The night was still and dark. The batteries were guided to their positions by the two glimmering lights of the bivouac lanterns, on which (line having been formed) the guns were laid point blank, and dark lanterns sent out to the front to serve as auxiliary points to lay on.¹ The positions of the guns were then fixed by means of swords stuck into the ground at the ends of the axletree arms. The line of sight from the foresight back to the tangent scale was illumined by another dark lantern held by the nearest number of the gun detachment, who also turned a light on to the tangent scale while it was being adjusted. Simultaneously with the battery getting ready for opening fire, the detachment in charge of General Martusheff's range-finder took position between the intervals of the batteries, and determined the distance to the bivouac lights. The range-finder gave the ranges as 820 sajene (1,913 yards) to the right hand target, and 975 sajene (2,274 yards) to the other. In order to distribute a fire over the whole depth of the target, the divisions of each battery varied the elevations they gave by one-tenth of a degree. For firing salvoes, it was deemed better to load half the guns with common shells and the other half with shrapnel, so as to ensure a better light being thrown on the targets by the simultaneous flashes of the bursts above and on the plane.² By one of the salvoes from the battery on the right, the lantern at the object was extinguished, and after this the battery had recourse to the auxiliary points of sight.

The batteries together fired 24 common and 20 shrapnel shells. On examination of the targets, it was seen that the one on the right had been penetrated by 7 whole shells, and struck by 403 splinters and by 392 shrapnel bullets; that on the left by 3 whole shells, 28 splinters, and 257 bullets. The shooting, taking the average, may be considered as "very good" at the right target, and "good" at the left.

The second night's experiments were carried out on July 25th. The heavy battery of eight guns, which had in its limbers 24 common and 16 shrapnel shells, was so placed as to be completely concealed by a fold in the ground. The targets were of the same dimensions as for the previous practice. The night was much brighter, with a moon partly obscured by clouds, which considerably facilitated the laying of the guns. The bivouac lights were not however visible when looking over the sights, but could be seen by a man standing up; the battery, therefore, laid their guns on the auxiliary points of sight, the requisite number of degrees elevation being given by the quadrant. The range-finder indicated a range of 1,420 sajene (3,314 yards). The firing of salvoes gave the following number of hits, viz.:—Shells through the target, 2; splinters, 239; and shrapnel bullets, 438. The quality of the shooting, judged by the average number of hits, may be pronounced "very good."

The night practice was preceded by preparatory drill at night in the gun park, which consisted of preliminary drill in loading, laying on a distant light, determining the elevation to be given on the tangent scale, and laying on an auxiliary point of sight made by means of dark lantern. The practice of the preceding days had already fixed the necessary variations to be made in adjusting the tangent sight when changing from common to shrapnel shell fire, as also the arrangements for adjusting the time fuze for the shrapnel,

¹ Formed by the battery's dark lantern, which had been fixed as first described, with the bright side towards the battery.—J. C. D.

² The advantage thus obtained would appear doubtful.—J. C. D.

and the corresponding change in the elevation to be given. Hence, the change from common shell to shrapnel was effected without hesitation.

This practice proved the feasibility of firing at night within the limits of the distance which could be given by the range-finder, if only one illuminated point were seen, even for a time. It was observed that for purposes of laying, the light given by one candle is sufficient up to a distance of 3 versts (3,500 yards). The preparation of the projectiles for firing and the loading of the guns at night produced no more delay than during the day-time. The preparation of the percussion fuze was done well and simply. That of the time fuze was also done by the light of a dark lantern without delay.

In preparing to open fire at a given range, it is necessary to see to the time fuze beforehand, while the battery is getting ready for action, as at night the duration of effective fire might be very short. It is difficult to lay the gun accurately by means of only one dark lantern, and it is indispensable that there should be one dark lantern for the tangent scale and another for the foresight. It may be remarked that the dark lanterns are unsatisfactory, both on account of their construction and from their burning vegetable oil (it being observed, *en passant*, that vegetable oil in a pure state is not to be met with), for the oil lamps often burn with difficulty and frequently go out; also, when the lantern is held in an inclined position the oil runs out, and therefore causes much difficulty in keeping the lamp clean.

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THE POSITION HELD BY ENGLAND AMONG THE NATIONS
OF THE WORLD ("DIE WELTSTELLUNG ENGLANDS"),
CLOSELY EXAMINED FROM MILITARY AND POLITICAL
POINTS OF VIEW, WITH SPECIAL ATTENTION TO HER
RELATIONS WITH RUSSIA.¹

By Major OTTO WACHS, of the Prussian Army.

MAJOR WACHS is a well-known German military writer, who has devoted special attention to the English Army and Navy. In 1882 he wrote on the projected Channel Tunnel, and in 1883 on the Egyptian Campaign, in the "Contemporary Review." He is also author of an able paper on "The Mediterranean from a Military Point of View," translated by Lieut.-Colonel C. W. Bowdler Bell (No. 125, vol. xxviii, Journal R.U.S. Institution).

The object of this notice is to place Major Wachs' views in a summary form before those readers of the Journal who are unable to consult the original, without criticizing the critic, who, if sometimes too severe, and sometimes ill-informed as to our shortcomings, is friendly in his tone, except where German interests appear opposed to ours.

Major Wachs introduces the subject of his work by quoting the description of England's position in the world by a French writer, as "a polypus with the body of a dwarf, and the tentacles of a giant clasping round the globe." He then gives a brief summary of the expansion of England, in which he says lies not only her strength but her weakness. It is, he says, length without strength, and has been easier to acquire than it now is to retain; and the world will no longer submit to be bound by the chain of England's dominion; her hand, she must feel, is against everyone, and everyone's hand against her. She is not only insulated but isolated. The time is past for getting and keeping peaceful possession, for there are too many rival and hostile Powers in the field. Referring to Napoleon's saying, "Six days' command of the Channel and on the fifth I shall be in London," he points out that England is exposed to many dangers. Major Wachs then asks the following questions: "Is the people the same as it was formerly? Is the mother country protected against all eventualities? Is she assured of the possession of her colonies? And can she keep up uninterrupted communication with them?"

Major Wachs states the object of his work is to answer these questions.

The British Islands.—Reviewing the defences of the south coast, Major Wachs finds that the harbour of Dover is not properly defended; Chatham is very incompletely fortified on the west side, although with reference to the defence of London, the conversion of Chatham into a strong strategical point is indispensable. As this has not yet been done, not only are the great marine establishments endangered, but the defence of the Thames is paralyzed, there being no fortifications above Gravesend. There is also a want of proper defences to the broad mouths of rivers, and to the important bays and harbours of the coast, such as the Clyde, Humber, Tyne, Bristol Channel, &c. Major Wachs does not consider England prepared for even passive resistance, and observes that the artillery force stationed in England is not sufficient to

¹ "Die Weltstellung Englands." By Major Otto Wachs. Kassel, verlag von Theodor Fischer, 1886. Pp. 142. Size 9½" × 6¼". Weight 14 oz. Price 4s.

man the guns mounted (940 heavy and 1,520 light pieces) on different systems. He doubts the efficiency of guns manufactured at Woolwich, and quotes an article in the "Times," of July 18th, 1886, "that Captains of English men-of-war had orders not to fire their big guns," referring to the bursting of guns on the "Thunderer" and "Collingwood." He remarks on the project for the defence of London by a chain of detached forts with fortified camps in the neighbourhood, that there are no means of manning them. "History tells of more than one attempt at invasion from the other side of the Channel which was delayed or frustrated by contrary winds. It tells also of some successful ones. . . . Above all, England should secure her docks, naval arsenals, and magazines, for their destruction would mean the fall of her naval power."

French Coast.—Referring to the harbours of the Channel, Major Wachs points out that there are three naval fortresses of the first class, Dunkirk, Calais, and Cherbourg; of the second class, Gravelines and Havre (the most important harbour after Marseilles); with other smaller fortified places, like Fécamp, &c. Boulogne is an enormous harbour of refuge, of great importance, while the gigantic works and immense strength of Cherbourg he considers to have been constructed for attack. Behind these maritime fortresses are the land fortresses of St. Omer, Lille, Douay, Arras, with double rail intercommunications and connections with Calais. In rear of all, in its central position, stands the giant fortress of Paris, with all its endless resources of men and matériel, connected with the Channel by many lines of rails, and also connected by river and canal with the Mediterranean. This waterway is of high strategical importance, as it allows torpedo flotillas to steam through France, from the mouth of the Seine to the Mediterranean, thereby turning Gibraltar. France has not abandoned the project of a canal for men-of-war, to connect Narbonne, on the Mediterranean, with Bordeaux, on the Atlantic; nor even the bolder project of a canal for armoured ships along the valley of the Rhone up to Lyons, through the Loire and Seine to the capital, and by Calais or Dunkirk to the Channel. This reminds Major Wachs that Russia also, when two or three years ago a conflict with England seemed imminent, provided for transport of torpedo-boats by rail from the Baltic to the harbour of Pontus. By the mobility of the torpedo element, France acquires a great strategical advantage over England. The following data show how dangerously near France is to England:—

Steamers cross in an hour and a half from Calais to Dover: from Boulogne in two hours and a half; from Havre in twelve, and from Cherbourg in fourteen hours; while the embarkation of troops and matériel can proceed on the largest scale, with the least loss of time, so that the English coast, of which the evening before saw not a single mast, would next morning behold an enemy's fleet at anchor, busily engaged in disembarking troops.

The Belgian and German Coasts.—Antwerp constitutes an immense danger for England as soon as Belgium allies herself with Germany or France. Then the deltas of the Rhine, now peaceful, would be fully armed, and the importance of Antwerp on England's left flank would be very greatly increased. A landing from here, as from the more distant German coast, would take England's south coast defences in rear. Wilhelmshaven, the great German maritime fortress, dominates the German Ocean in spite of Heligoland, and is only twenty-two hours by steam from the coasts of Norfolk and Suffolk.

England's Colonies on the Atlantic.—Halifax is strongly fortified, and has a coal dépôt, but is without docks. It is an important harbour, being near the United States. The whole Canadian frontier, from Kingston, on Lake Ontario, which is practically undefended, up to Fundy Bay, is devoid of all supporting positions. There is not even protection to the important Gulf of St. Lawrence. The Canadian Pacific Railway is 2,900 miles long,

and shortens the road to New Hamilton and Hong Kong by 630 miles, while it permits the transport of troops and matériel to the island of Vancouver in 14 days (7 by sea and 7 by land). This line is important for concentration, and is a distinct gain in military force. But Canada has shown great want of foresight in the matter of protection, and the western terminus seems dangerously threatened by the United States.

In the West Indies, Bermuda, with its capital, Hamilton, is strongly fortified, possesses a coal depôt, and the only dock in North America.

Jamaica has a fortified coal depôt. Antigua and Barbadoes are second class coal depôts. Ascension and St. Helena coal depôts of the first class. "The loss of Ascension and St. Helena would be for England the loss of the sceptre of half the oceanic world." The Falkland Islands, with Stanley Port, could be easily fortified, but, although the last link of a long chain, they are utterly unprotected, notwithstanding that they cover that great ocean defile the Straits of Magellan. At the Cape, England offers a hopeless (?) resistance to the German and Dutch elements, the hard pressure of which is strong enough to keep ever before her the warning, "Friend, feel my strength, and take care!"

Cape Town is not properly fortified, although a first class coaling station; nor are even the rich coal-mines of Natal connected by rail with the coast; Simon's Bay is only secure against a *coup de main*. Great docks are even wanting at this boundary of the two hemispheres. The southern points of America and Africa are quite *en l'air*.

Cutting of Panama.—Major Wachs believes that in a few years a passage will be cut by M. Lesseps through the Panama Isthmus, 22 metres wide at bottom, 9 metres deep, and 44 English miles long from Panama to Aspinwall. A second interoceanic canal will connect the harbour of Juan de Nicaragua with the harbour of Brito by way of the San Juan river and the Lake of Nicaragua, which is only 42 metres above sea-level. This latter is being undertaken by the United States. There is also the projected ship railway across the Isthmus of Tehuantepec, but the practicability of this is doubted. The completion of the Panama passages will have immense results. The West Indian Islands will acquire a hitherto undreamt-of importance. Central America will come more under the influence of the United States, and the Monroe doctrine be given a wider development. "The history of the American Pacific and of the American Atlantic will tend to confirm a law, not hitherto sufficiently taken into account by England, that the ocean does not always command the coast, but that, in certain circumstances, the coast commands the ocean; and the gigantic works in Central America will contribute to make this law good. Here a knot is formed that only the sword can loosen. There will be harder fighting for the ditches between the Atlantic and the Pacific than there has been for the passage from the Mediterranean to the Red Sea, though it must not be forgotten that the last word has not yet been spoken on the Suez Canal question, and that new complications may arise." Major Wachs reproaches us with our inaction and irresolution in allowing the favourable opportunity of the great War of Secession for putting down our dangerous rival for the dominion of the North Atlantic to pass away.

When the war which he foresees with America once commences, he prophesies the loss of Canada, which he supposes not to have forgotten its French origin.

The Baltic.—The dominion of the Baltic is shared between Russia and Germany, though the weak hand of Denmark still holds the key. When the great North Baltic Canal through the Jutland Peninsula is opened, the command of the Baltic and of the eastern part of the North Sea will be in the hands of Germany. The Russian harbours are frozen up till late in the spring. The North Baltic Canal, 100 kilometres long, 8·5 metres deep, with

a breadth at bottom of 26 metres (therefore 4 metres broader than the Suez and Panama Canals), is constructed mainly for military objects, and is a defensive canal connecting Kiel and Wilhelmshaven. When this canal is opened, the distance from the great maritime fortress of Königsberg to the mouth of the Thames is reduced to 1,500 nautical miles (2,780 kilometres). Dantzig, Stettin, and Kiel are brought nearer to England; and in all these great German harbours, there are good arrangements for the embarkation of troops and matériel. England has therefore to reckon with another factor in her strategical calculations.

The south coast of England, opposite Cherbourg, has some fortified harbours, although insufficient. The coast opposite Germany lies almost open and unprotected.

The author concludes this section by briefly noticing Revel and Cronstadt, observing that Windau in Courland is to be made into a fortified harbour, and connected by rail with the interior.

The Mediterranean.—Gibraltar, he observes, though strong, has no docks, although frequent collisions occur near it. Cyprus occupies a most important position, but it is incomprehensible why Famagusta has not been made a secure harbour and fortified.

Syria and Mesopotamia.—The Euphrates route would shorten the journey from London to India by 1,000 miles or ten days. Its construction would encourage the Armenians to oppose a barrier to advancing Russia. But it will soon be too late. England has no position north of Cyprus to oppose to Russia's formidable offensive power in the Black Sea. Sebastopol is now protected by detached forts, and has had its docks restored. Novorossiskaia is being converted into a second great maritime fortress, with a large harbour in a sheltered bay, with a breakwater. Its sea-defences consist of three well-placed batteries, and some torpedo-boats. Petroleum is led here by pipes from the springs, and can be pumped on board the Russian war-ships in the harbour. There are also harbours, as at Odessa (the station for the Russian volunteer cruisers), well protected by batteries, mines, torpedoes, and two circular ironclads; at Oezakow, Balaklava, Theodosia, and there is the formidable Kertch, the key of the Sea of Azov. There is also Sukum Kali, which joins a magnificent military road with Cis-Caucasia, Poti, and finally Batoum. This immensely important place was made into a Russian fortress in spite of the Treaty of Berlin. If Nicolaieff is the second Sebastopol, Batoum is the third.

Russia in undisputed possession of the Black Sea means her future possession of Constantinople, and that means her establishment as a great Mediterranean Power.

The Indian Ocean.—Referring to ports held by Germany on the African coast, the writer hails it as a possible development of a German India in Central Africa. In Madagascar the French are striving to obtain a commanding position. These circumstances give increased value to the fortified harbour of Port Louis, with its docks, as an important refitting station.

Major Wachs admits the great strength and vast importance of Aden, the Gibraltar of the East, but alludes to its dependence on a condensed water supply as an element of weakness. Perim (65 metres above sea level) is, he states, entirely commanded by Mount Machali (270 metres high), at the foot of which the French have a settlement. He states that 100 miles south of Suakim is Akik, the best harbour on the Red Sea, and that, it is believed, the English intend to occupy and fortify the Island of Bahdur opposite that harbour (?). He describes the position of the Italians at Massowah (opposed to the Abyssinians) as "between the devil and the deep sea." Assab in Habesh is a better position, being exposed to the north wind.

Major Wachs considers the Suez Canal essential to England as a military

high road to India, and that it is Russia's great object to get possession of it. This applies not only to the canal, but also to the isthmus and to Egypt itself. The canal saves England 1,710 geographical miles, or 12,700 kilometres. The phrase "Time is money" may now be rendered "Time is victory." England, he thinks, can never give up Egypt.

Turning to India, Major Wachs considers Kurrachee very insufficiently protected by a Hindoo fort of the last century, which, though armed with heavy English guns, would crumble to pieces before heavy naval guns. Aden, according to him, is the only strong place in the Indian Ocean.

Central Asia.—The Russian lines of communication can only be threatened from the Black Sea, so that there is an intimate relation between the Straits of Constantinople and Herat. The Black Sea being a *mare clausum* of Russia, gives her the immense advantage of being able to collect her forces on its shores, of steaming across to Poti and Batoum, and thence by rail across the Caucasian isthmus. Financial difficulties alone have hitherto prevented Russia from tunnelling through the Kasbek and continuing the line southwards to Vladi-Kafkas. The projected railway between Novo-Russik on the Black Sea and Petrofski on the Caspian will double Russia's strength and mobility in the Caucasian isthmus. (See No. 124, vol. xxviii, and No. 128, vol. xxix, Journal R.U.S.I.)

Russia must force her way to the ocean, although vital interests of England may be endangered and Anglo-India threatened. Major Wachs, like some others, considers the Russian system far better adapted for assimilating and semi-civilizing the Asiatic tribes than the English, and even that it gives better security for life and property (?). On the one side the Cossack Mercury gallops in front; while on the other side English commerce makes a road for the sword. Russians, like Britons, are bringers of civilization into Asia, but they act in very different ways. Russia acts like a genuine Asiatic Power, crushing out all nationality, and ruling by the sword what has been won by the sword.

England is no longer in a position to oppose Russia's advance in Central Asia. That opportunity was offered when the Turcomans hoped to find in England an ally against Russian oppression; and as a visible sign of this expectation branded their horses with the letter V. (Victoria). But unfortunately this opportunity for acquiring 100,000 of the best irregular cavalry in the world was lost to England. These are now Russianized, and ready to carry out Skobelev's prophetic words: "We must form masses of Asiatic cavalry in order to hurl them on India under the banner of blood and rapine as a sort of advanced guard that shall bring back the times of Tamerlane." Herat is now the most salient point in Central Asia. Major Wachs has much to say on Herat and the Afghan boundary question, but nothing new to the readers of this Journal. In eloquent terms, he urges England to awake, as "India is worth fighting for!" The hope entertained that Afghanistan is a bulwark for India is a delusion. From the most ancient times down to our days, the defenders of the plains of Lombardy have never succeeded in denying the passage of the Alps to an invader; and the same law holds good in Asia with respect to the Himalayas. Major Wachs believes, with many other authorities, that instead of restricting ourselves to the line of the Indus, we should hold the strategical positions of Ghuznee and Candahar, which are to India what Strasburg and Metz are to Germany. The first thing to be done is to make Quetta a strong position for attack or defence. From thence, as a base, the English would be able at any moment to occupy the country between Ghuznee and Candahar, and to make it impregnable by field fortifications, for which the ground is well adapted. As a matter of course the Bolan Pass should be strongly fortified, and the plain of Pishin occupied in force as a first class military position.

Referring to the abandonment of Candahar, the writer observes: "History will, probably, in describing the decline of England's development in power, begin with the name of Gladstone." Major Wachs' remarks on the danger and loss of prestige involved in abandoning the offensive and waiting for Russia on the Indus, where the loss of a single battle would mean the loss of the Empire.

He, however, commends us highly for taking possession of Burmah.

The North Pacific Ocean.—The writer expresses astonishment that such an important strategical position as Singapore has not been secured by fortifications, as this must be the first *point d'appui* for English operations in southern Chinese waters. Possibly the English hesitate, because by cutting through the Isthmus of Malacca at Krah the military and commercial position of Singapore would be ruined.

Referring to New Guinea, where the German flag floats alongside the English, Major Wachs dilates with pardonable exultation on the development of German colonization and on German strength holding fast what German daring has seized. The lines of steamers also serve the purposes of colonization, and may easily be turned to war purposes by carrying guns, ammunition, and even torpedoes.

On the Australian continent England has only fortified King George's Sound on the south-west, and Sydney on the east coast, besides throwing up some weak forts for the protection of Fort Jackson. There are no docks; so that, incredible as it seems, it is nevertheless true that England's Australian squadron depends on the home docks. Port Philip, protecting Melbourne, has three detached forts, but with the exceptions before mentioned, all other harbours are open to an enemy. The position of New Zealand, where a big dock is being constructed, points it out as, in the future, being to Oceania what Great Britain is to Europe.

As Australia is poor in coal supply, the construction of fortified coaling stations should be energetically taken in hand, the nearest Asiatic coal depôts being Ceylon, Singapore, and Hong Kong. The north and north-west coasts of Australia have been fortified by Nature with coral reefs.

East Asia.—In taking possession of Burmah England has made a fresh start; "has wound up a new clock to tell the Asiatic time of day." Military considerations determined the conquest of Burmah, the commercial interests playing this time a secondary part. It corresponded with the extension, not to say consolidation, of the French acquisitions in Tonquin and Annam.

Major Wachs considers France has got into a dangerous *cul-de-sac*, but that she had planned it otherwise. "Upper Burmah in the hands of France was to have been the sword of Damocles suspended over India." England recognized this and acted accordingly. Anglo-India has still some intermediate ground between her and India, though certainly not for long, but she has suddenly acquired earthly touch with the Celestial Empire."

Major Wachs makes some interesting remarks on the alliance between France and Russia, which he considers degrading to the former, as serving the cause of barbarism against civilization. Frederick the Great, "der Alte Fritz," foresaw that Europe would one day be forced to combine against the Empire of the Czars when he wrote: "Je n'y vois plus de remède qu'en formant avec le temps une ligne de plus grands souverains pour s'opposer à ce torrent dangereux."

Upper Burmah offers a natural military and commercial high road between India and China. "The Irrawady is navigable for 850 miles from its mouth, while sailing vessels can get 150 miles further."

Major Wachs observes that the permanent possession of Hong Kong is indispensable to English prestige in China and Japan and for her commerce.

"Yet England bases her military position here on five coast batteries of slight profile which are often nearly washed away by the tropical rain storms before their repair is thought necessary (?)." He considers that Hong Kong, although a first class coaling station and rallying point for the fleet, is as respects fortifications defenceless. When Major Wachs wrote Port Hamilton had not been abandoned, the possession of which he considered somewhat diminished the military importance of Hong Kong. He points to Hainan as commanding the Gulf of Tonquin, but considers Formosa the most important position, since it commands the Fukian Strait as well as the channel to the principal harbours of China and Japan. It is also rich in coal. The islands of the Chusan Archipelago commanding the inland waters of China are not yet fortified. Corea will have a great future, and the question is what interest will predominate in this part of the world, whether that of China, Japan, England, or Russia. Port Lazarew—where Russian surveyors have been heard of—is the best harbour at the foot of the great peninsula, as it is never frozen over. Major Wachs remarks on the wakening up of China, on her armour-clads building in Germany, her torpedo flotillas, docks, arsenals, &c., and on her harbours being protected by strong forts and batteries. Foochow has its great gun foundries, small-arms factory, military school and other military establishments. China was by no means exhausted by her war with France, who got little "gloire" out of it. China looks also suspiciously on her great neighbour—Russia, which, ever quietly advancing, built her first point of support, Fort Nicholovsk at the mouth of the Amour, in 1849, and has now acquired a large tract of territory together with the important harbours of Wladimir Bay, Olga Bay, Wladiwostock, Peter the Great Bay, and Possiet Bay. All these places have a garrison beyond the requirements of defence. In twenty years the Russians have got 800 English miles nearer to Hong Kong, while their stations on the Amour are within 100 miles of Peking.

Wladiwostock is a first class Russian fortress, or rallying point for the fleet, with a naval arsenal; four swift cruisers of the "volunteer fleet" lie here in readiness: for many months, however, it is impeded by ice. Major Wachs gives England great credit for taking possession of Port Hamilton (and we suppose proportional discredit for giving it up). By hoisting the English flag there, a sudden check was given to Russia's eager attempts at getting harbours free from ice on the East Asiatic coast, and her further progress in the China and Japan seas arrested; from Port Hamilton England watches closely the Russian coast and commands the Korean Straits. In taking possession of Port Hamilton England answered Russia with an "eye for an eye and a tooth for a tooth."

Russia stretches out her mighty hand from a compact mass of half Europe and a third of Asia, while Britannia rules the sea from many distant points. Russia hems in and jostles England by land, as the great sea Power does the inland Empire by water. Russia looks forward to the future, and taunts its hated rival with having no hopes for its future. Neither in the near nor in the distant East, can English interests ever be reconciled with Russian.

Major Wachs enquires why should there not be a triple alliance between England, China, and Japan, in which England should lead? China need only be stirred up to remember Russia's aggressions in Manchuria, in Mongolia, on the Thi, in Kashgar, and more recently in the Corea. To rouse Japan it should only be necessary to point to Saghalien (taken from Japan in 1873) and to mention Tsusima. But there are many other weighty reasons that could be urged to get China and Japan into the service of civilization, and to make Russia reap the whirlwind where she has sown the wind. It is Russia that is here weak and should tremble before these Oriental Empires, China

having a population of 490 millions and Japan of 40, while the Amour territory of the Czar has not one million souls. China has 180,000 to 200,000 troops on the Russian boundary. Russia having throughout Siberia only weak cadres, though she thinks to influence Central Europe by massing troops in Russian Poland, China advances her lines of railway and telegraph and gets ahead of Russia in military power (?).

Russia's East Asiatic possessions would be *en l'air* when her communication by sea is interrupted. Major Wachs considers Port Hamilton as a coaling station of immense advantage to England's blockading squadron, and it is to be hoped that in case of war we could retake possession of it.

The Island of Vancouver in front of the rich province of British Columbia, in the enviable possession of coal, iron, and gold mines, with abundance of good ship-building timber, is clearly intended to play a great part both in a military and commercial sense; this important island is practically defenceless, although threatened by Russia from Asia and in the immediate neighbourhood of the United States. In 1878 an attempt was made to protect the naval establishment and dry dock by the construction of some badly placed and worse armed batteries, and some slight attempt at defence on the land side. Nor is the terminus of the Canadian Pacific Railway protected at Port Moody. Major Wachs is of opinion that "to rise to the level of the situation from a military point of view" every effort should be made to prepare everything in Columbia so as to be able to shift the base of operations to Japan, and then act against Russia in East Asia. Returning to the Isthmus of Panama, Major Wachs observes that should M. Lesseps not succeed with his canal (which he here admits to be very doubtful) we shall have to count on the St. Juan Canal being made by the United States. This will become the great world passage, utterly annihilating Cape Horn and the Straits of Magellan as a sea route, also doing much injury to the Cape of Good Hope.

England's Fleet.—Besides securing the mother-country the fleet has to protect more than 5,000 merchant vessels (Sir Charles Nugent makes it nearer 20,000) on all parts of the globe. It has to be the string on which the separate heads of her Colonies are strung, or in other words every war-ship of the English fleet is a link of the great iron chain which binds the immense Empire together. This fleet has founded the British Empire and till now sustained it. The English fleet is, however, relatively weaker, for although her men-of-war are nearly double those of France the number of armoured ships in both navies are nearly equal. Steam has deprived England of her superiority in seamanship. Since the ship has become a machine, the engineer replaces the sailor. Sea tactics and sea strategy have changed, but to what no one knows for want of practical experience. The torpedo Major Wachs calls the assassin of the sea, but thinks the French overrate them. Speed is now much more in request than thickness of armour-plate.

There was a time when it was England's boast that her Navy was more than a match for the navies of all other nations combined, but that time is past, and if France and England are not already evenly balanced it is certain (?) that the fleet of the French Republic combined with that of Germany or Italy would be at least equal, probably superior, to England's naval force.

Italy has or had till lately three mightier ironclads and Germany had more torpedo-boats than England. Ships of war are now built by Germany for foreign States and equipped in German arsenals.

England in spite of her coal and iron is being beaten by Germany and France in the manufacture of armour and the building of ships.

Major Wachs then alludes to our bending bayonets and jamming cartridges, and points out that Krupp can make better guns than the Royal Foundry at Woolwich. Foreigners may well doubt if England still rules the sea. "But

England herself—despite her Admirals and Generals, and in utter misconception of facts which prove that the Empire's rule over the waves is a thing of the past—still places unlimited confidence in her fleet."

The strategical problem for England's fleet is how to keep open her numerous lines of communication, and yet to be in commanding strength at the important naval points and stretches of coast. The separation of her fleet into independent squadrons weakens her power of concentration and of undertaking combined operations. Major Waechs points to the unprotected state of many of our coaling stations, and to the absence of dockyards in the southern hemisphere, both as indispensable to a fleet as reserves and supplies are to an army. He considers the German naval regulation as to the formation of reserve divisions of seamen in Kiel and Wilhelmshaven very superior to any corresponding regulation in the English Navy (!). Vice-Admiral Aube, French Minister of Marine, has expressed an opinion that twenty fast well found cruisers would suffice to ruin England's commerce. Gougeard would strike a deathblow at England in the Mediterranean by cutting her line of communication with India. "The Mediterranean has plenty of hiding places. Didn't Napoleon with a heavy fleet of transports succeed in evading the falcon eye of Nelson?" Gabriel Charmes again recommends sending out cruisers to prey on England's commerce in every sea and ultimately starving the country out.

France, as stated by her Admirals in the Chamber of Deputies, is seriously undertaking to make her fleet equal to that of England. What, asks Major Waechs, would happen if England's Navy were defeated, if England found her confidence in "the silver streak" as a protection, an idle dream?

England's Army.—After commenting on our Army Major Waechs observes, these numbers bear no comparison with those of Central European States, and almost disappear when looked at beside the armies of Russia, France, Austria, Italy, or Germany. In the world's battle they would count for very little, "well as the British soldier may fight," although we venture to think the militia and volunteers somewhat behind. "With such a weak instrument it is impossible for England to maintain her authority in all corners and ends of the world, to make good her title to her possessions and to guarantee her future security."

Quoting from his essay in the "Contemporary Review" for April, 1883:—"In the struggle impending sooner or later between Russia and England in Asia, the fleet will indeed have little part, and success requires the other arms to be well prepared. Egypt will bring England to the consciousness that she is the least of the land Powers of Europe. When England reaches this consciousness then the Egyptian question will have reached its height, the nation will militarize itself, and from that time England will have nothing to fear in either Europe or Asia." The force of circumstances will, Major Waechs thinks, compel England to adopt conscription. There is a limit to peace when a great Power cannot avoid war when it becomes a struggle for existence.

Telegraph Lines.—Major Waechs thinks it unpardonable that England has no telegraph cables to Bernuda, Ascension, St. Helena, Cape Coast Castle, Lagos, Fernando Po, the Cape of Good Hope, or the Feejee Islands.

Conclusion.—Major Waechs now asks, "Can England, who has lived as the wealthy heir of the past, hope for salvation in the future?"

"Can a great Imperial Power maintain itself at sea without taking up the position of a great Power on the land? If this is denied, is not the defence of English territory in all parts of the world condemned, since the foundations of her power and national independence are exposed? For the first and perhaps the last time in modern history, an attempt is made to maintain an Empire on a mobile element by planks fastened together without having

corresponding powers on land. Besides, England no longer finds good anchoring ground everywhere as formerly she did. For is not the German Ocean removed from her supremacy as is a portion of the North Sea? Has not Albion already got to share her dominion over the west basin of the Mediterranean with the Third Republic? Is not united and favoured Italy about to improve her political situation and to maintain positions? Will not Austria, that leaves us the Adriatic with Bosnia and Herzegovina in the background, one day appear on the left flank of the salt highway to India, and look out from Salonica on the promising vista for the 'Ostreich' the Eastern State? Or would England prefer to see Russia, whose history will continue to be written in characters of blood, as ruling Power in the Ægean Sea, ruling in spite of Cyprus, Rhodes, &c.? Does not France already possess Toulon and Marseilles in the Mediterranean on the British line of communication to India? And in the Atlantic, Brest, and Cherbourg? Can it be forgotten in England that France is in the happy position of being able to ship expeditions within a few days from the south as well as the east coast?" The writer enquires if England can possibly maintain her position in the Mediterranean when the crash comes, as the Ottoman Power can no longer be a screen? Besides, Germany, Austria, and Italy are in the Levant. "While England has her ships and an inferior land force, those Powers possess a powerful united fleet, and behind it the greatest land force the world has ever seen. And further: do not English interests in American waters collide with the stars and stripes as in African waters with the French? Have not the Russians almost gained touch with the French on the distant Asiatic coasts of the Pacific Ocean? And are not the Germans all over the southern seas? Would any road save that through Canada remain to Britain when the Suez Canal is destroyed or blockaded and the Islands of Ascension and St. Helena in enemy's hands? Does not experience teach us that the commercial and industrial expansion of a people can only be securely based on political prestige and military power?" After referring to our misfortunes with the Zulus and Boers, to Egypt and Khartoum, the writer continues: "And how above all does England think to keep the Russian Colossus off India, towards which he is ever advancing and ever more threatening? Where are the strong hands, the mighty armed columns to lay down a frontier he shall not put back?" After much more in this strain—"We know very well that a giant does not die from the prick of a pin, we know that mighty English people who are still the same at bottom, against whom half the world may rage in vain when that people rise in holy wrath to defend their threatened national existence. But it will not require half the world to shatter England's power—while Russia and France with Mephistophelian pleasure look back over their shoulder, Germany wishes England to be full of energy, united as itself, no longer supine in military and naval matters, but that even in the eleventh hour she would put her house in order, for the twelfth hour approaches, and that the answer to "Watchman, what of the night?" may not be "Some day perhaps it will be morning." Major Wachs concludes thus: "It does not need to be a prophet or the son of a prophet to understand the meaning of the handwriting on the wall. The Slavonian high tide in East as well as West threatens *Britain first*, and in so far as the Queen of the Sea puts up defences and mans them, then in the time of need, when all ties of friendship are drawn tighter, the ties of blood will be remembered, and Germany will not hear the neighbour's alarm bell unmoved. As before she will be at the decisive spot before evening. So let us part with brotherly clasp of the hand and hopes of true comradeship in arms."

GERALD GRAHAM,

Lieut.-General.

NOTICES OF BOOKS.

The Interchangeable War Game Maps. Invented by Lieutenant S. SHARP, 3rd Middlesex R. V. Corps.

Although the notices in Occasional Notes are intended for literary work only, the Honorary Editor considers himself at liberty to include in them accounts of any device, home or foreign, which may have been brought into existence for the purpose of aiding members of either Service in the study of their profession. Hence our reason for noticing Lieutenant Sharpe's Maps. The word "Maps" does not indicate the full value of the invention; for it means really a very cheap and portable "Kriegs-Spiel apparatus." The remarkable feature in the maps themselves is, that each of the sheets of the whole set of nine, whether the right way up or reversed, is interchangeable with any other sheet of the set. Place them in any order on the table, and the contours and roads always fit. Insert among them the river slips and we have a representation of fresh ground. The possible combinations available for Kriegs-Spiel schemes, and also incidentally for the practice of map reading, are numbered by millions. The maps are on the six-inch scale and are contoured at 50-feet intervals; woods, roads, and water are coloured. Each sheet and slip is lettered in the corner so that a mere memo. to a combatant enables him to arrange the maps in the proper order for the study of the forthcoming encounter. Each sheet is 2 miles by 3 miles. When, further, we find that a complete set of nine maps can be obtained for a guinea, and the same sum covers the red and blue blocks necessary for a Kriegs-Spiel, it will be evident that we have, at last, a Kriegs-Spiel apparatus available for intra-regimental and intra-company instruction in tactics. Twenty sets have already been ordered by the military authorities.

L. A. H.

Der Deutsch-Dänische Krieg, 1864. Herausgegeben vom Grossen Generalstabe. Zweiter Band. Berlin: Mittler, 1877. Pp. 537. Size 10" x 6 $\frac{3}{4}$ " x 1 $\frac{1}{4}$ ". Weight under 2 $\frac{1}{2}$ lbs. Price of work complete 1*l.* 16*s.*

We welcome with renewed pleasure the appearance of the second and concluding part of this graphic narrative. In recurring to our remarks in No. 140 of the R.U.S. Journal we only do so as desiring to point out how thoroughly the interest of the reader is sustained up to the very conclusion of the campaign.

The present volume, also as the foregoing one in three sections divided into 17 chapters, with maps, plans, and supplementary appendices, carries on the general narrative from the 18th April to the end of the campaign and the conclusion of peace.

The fourth section covers the operations which led to the fall of the fortified position at Düppel, depicts the increase of the siege material, the operations of the formal siege, and the storm of the line of works.

Section 5 treats of the movements of the 1st Army Corps up to the conclusion of the first truce, the operations in North Jutland, and at sea, the negotiations at the Conference of London, and the aspect of affairs during the truce.

The sixth section brings this history to a conclusion; embraces the conquest of Alsens, the operations in Jutland, the occupation of the North Frisian Islands, and the conclusion of peace.

A short chapter briefly reviews the campaign, and concludes with a sentence which amply confirms the remark which we ventured to express in our review of the first volume. It is briefly as follows in liberal translation:—

"From a military point of view the experiences gained in the Danish War proved of use in the Bohemian, as did those of the last-named affect the French War. Under careful consideration one also perceives that, already in this first campaign, notwithstanding embarrassing circumstances, each great feature of the conduct of war not only appears, but more and more becomes prominent, which at a later period becomes developed, and lends a like impress to all three wars, which, different as were their aspects, were carried to a conclusion by William the King."

In conclusion, we can only reiterate, with full emphasis, the expression of opinion as to the value of the work which concludes our former brief review.—B. W.

Publications of the Manchester Tactical Society.

It is desirable to bring to the notice of members of the Institution the valuable series of pamphlets issued by the Manchester Tactical Society. Without placing them in any way according to their relative importance, they are as follows, and all of them deserve careful perusal:—

Suggestions for a new Field Exercise for the Volunteer Infantry, by Captain H. Spenser Wilkinson. Price 6d. Volunteer Artillery, by Lieutenant-Colonel Birley. Price 6d. English Drill. A Historical Sketch by Lieutenant-Colonel Aspland. Price 6d. Exercises in Strategy and Tactics. Translated from the German by Captain S. Wilkinson. Price 2s. 6d.; and Essays on the War Game by the same writer. Price 1s. In these publications the authors do not air their own special nostrums, but deal clearly and temperately with the subjects they take in hand.—L. A. H.

Decisive Battles since Waterloo; the most important Military Events from 1815 to 1887. By T. W. KNOX. New York and London: Putnam and Sons, 1887. Pp. 477. Size 9" x 6½" x 1½". Weight under 2½ lbs. Price 10s. 6d.

The author refers in his preface, as was to be expected, to Creasy's well-known work, "The Fifteen Decisive Battles of the World from Marathon to Waterloo," quoting the following remark of its writer: "It is probable indeed that no two historical inquirers would entirely agree in their lists of the decisive battles of the world," and adding "it is of course still less likely that any unanimity of opinion could be found among historical students of the present day in the selection of the decisive battles since 1815." This selection seems to depend upon the meaning attached to the word "decisive." Decisive of what? Of the fate of a nation, of a sovereign or of a cause, and thus affecting the history of the world? Or merely of a campaign, the immediate result, however conclusive, having only a partial and temporary influence? The former of the two definitions seems the more appropriate, and that which Hallam had in view when he formed the passage which Professor Creasy chose as a motto for his work: "Those few battles of which a contrary event would have essentially varied the drama of this world in all its subsequent scenes."

Whether this definition would, if strictly interpreted, apply to all Professor Creasy's fifteen battles is doubtful, but it certainly does not apply to the whole of Mr. Knox's twenty-five, some of which were only of importance to the troops actually engaged, whilst others, though decisive as far as the very limited area of the conflict extended, were of no consequence to the world at large. After reading the author's descriptions of some of the most important battles which he has selected, we can honestly commend his industry and his general accuracy as to dates, numbers, names of persons and of places, to which, however, the following passage in page 309, Chapter XVII, treating of the battle of Königgrätz, is a remarkable exception; "The two great armies advanced to meet each other, the Austrian northern army under command of Field-Marshal Benedek entering Silesia, where it was joined by the Saxons." We cannot recommend this work to the student because the author with all his industry appears to us to fail in getting a good grasp of his subject. His attention is too often engrossed by minor and unimportant details, and he does not perceive and therefore does not explain the main cause of success or of failure. His descriptions of ground too are seldom clear and comprehensive, though supplemented by a large supply of conveniently placed

maps and plans. The "Decisive Battles," though hardly suited to a professional library, will probably be acceptable to the general public.—L. G.

England and Napoleon in 1803. Edited by OSCAR BROWNING. London: Longmans, Green and Co., 1887. Pp. 295. Size 9" x 6" x 1½". Weight under 1½ lb. Price 15s.

Whilst the officials employed at our own Record Office are still occupied with the historical documents of the 16th century, Governments of other countries, regarding historical investigations from a more utilitarian point of view, are bringing forward researches which throw light on the present rather than on the past; the French Government is publishing the correspondence of Barthélemy in 1792; Germany is printing public documents of the first decade of this century; Russia is loading our shelves with the most precious information about the Empress Catherine and the Emperor Alexander. "We not only neglect to place our case before Europe, but we allow it to be stated by foreigners." Such is the fair comment of Mr. Oscar Browning. The Royal Historical Society have generously published this collection of despatches contained in the volume before us, the editorship of which has been placed in hands thoroughly capable of performing the work. The documents throw light on a most important period of English History, and form a most valuable contribution to Historical Literature.—L. A. H.

The History of the Second Queen's Royal Regiment, now the Queen's (Royal West Surrey) Regiment. By Lieutenant-Colonel J. DAVIS, F.S.A. Vol. i. London: Richard Bentley and Son, 1887. Pp. 322. Size 10½" x 7" x 1½". Weight under 3 lbs. Price 24s.

As we have, in a notice of a regimental history in a previous number of the Journal, already said, there are regimental histories and regimental histories. The general character of English works of this class does not prejudice readers in their favour; and therefore it seems desirable, with Colonel Davis's book before us, to at once endeavour to disarm that prejudice, by saying that the History of the Second Queen's is a work which stands out prominently above the rest of its kind. The Second Queen's dates its existence from 1661, and was actually the first regiment, after the Guards, placed on the establishment. The very name it was originally given, the "Tangiers Regiment," indicates its connection with a most interesting period of national history, in the events of which the Second Queen's took a conspicuous part. Colonel Davis therefore has not gone beyond the limits of regimental record in combining with the detailed accounts of the encounters in which the Second Queen's participated a history of that in which those encounters took place, the occupation of Tangiers; Colonel Davis has by dint of patient research and great labour written a most interesting page of English history, and at the same time has included in it well written accounts of the services of the gallant regiment to which he belongs. We have no doubt that the standard Colonel Davis's first volume reaches will be maintained in those which follow; and in that case we shall have at last a really good regimental history.—L. A. H.

Journals kept in Hyderabad, Kashmir, Sikkim, and Nepal. By Sir R. TEMPLE, Bart. Edited with Introductions by Captain R. C. TEMPLE. London: Allen, 1887. 2 vols. Pp. 576. Size 9" x 6" x 3". Weight under 4 lbs. Price 32s.

In this very interesting work, the author has supplied the journals and illustrations, the editor the introductory notes and maps. The Government diary is entirely a political one, and presents a true picture of an important part of the daily life of a British Diplomatist at an Oriental Court. The diaries in Kashmir and Sikkim are purely descriptive, and are mainly notes of brief tours in those interesting portions of the Himalayas, but the three journeys over the Banihāl Pass were made off the beaten track by an unfrequented route, and so the descriptions of them afford information that must necessarily be new to most readers.—L. A. H.

Records of Service and Campaigning in many Lands. By Surgeon-General MUNRO, M.D., C.B. London: Hurst and Blackett, 1887. 2 vols. Pp. 789. Size $7\frac{3}{4}'' \times 5\frac{1}{4}'' \times 2\frac{3}{4}''$. Weight under 2 lbs. 10 ozs. Price 21s.

Dr. Munro's services extended over some 37 years from 1844 to 1881 in all the quarters of the globe, in South Africa, in Nova Scotia, Bermuda, the Crimea, and in India during the Mutiny and afterwards. Although the basis of the records is autobiography the writer has looked beyond himself, and has given much valuable, and, in many cases, very detailed information respecting the operations in which he was concerned, and which he himself witnessed. A Medical Officer who has served in the Kafir Wars with the 91st, and in the Crimea and the Indian Mutiny with the 93rd, cannot fail to have seen much of real war; and his experiences are pleasantly put before us.—L. A. H.

The Corsairs of France. By C. B. NORMAN (late 90th Light Infantry). London: Sampson Low, 1887. Pp. 453. Size $9'' \times 6\frac{1}{2}'' \times 2''$. Weight under 3 lbs. 2 ozs. Price 18s.

"In the last great war," 1793-1815, writes the author in his preface, "our Admiralty issued 10,000 letters of marque, yet despite that vast addition to our naval strength, we lost close on 11,000 merchant vessels, and we captured but 1,000 of the enemy's privateers. . . . Treaties are still made to be broken, and I presume no sane man in the United Kingdom harbours the most distant hope that privateering will not be vigorously resumed in the next great war in which England is engaged. . .

. . . France with a trade just one-third of that of the British Empire, and with a mercantile marine numbering but 2,000 ships against 19,500 flying our flag, can boast of a navy little if at all inferior to our own. The havoc she might play with our commerce is self-evident. The havoc she wrought in bygone days is long since forgotten . . . despite our boasted maritime superiority, France was always able to inflict upon us crushing damage. . . . These pages show how grievously we suffered at the hands of our hereditary foes in earlier days; the map which heads the volume shows how easy it would be to inflict a like damage in future years. Her naval stations dominate every commercial route we possess, and as yet our coaling-stations are unfortified, and our swift cruisers unbuilt. For the last three years the French press has teemed with articles discussing the best means for carrying out the ideas of Duguay Trouen, and of Surcouf ('two noted Corsairs'). Admiral Aube's inhuman proposal to bombard defenceless watering places, and to torpedo our own large merchant steamers with their living freight of hundreds of souls, met with no reprobation in France; on the contrary, they led to his appointment as Minister of Marine. We are fully warned as to what we may expect in the future."

Mr. Norman's book is but one more attempt, hopeless as it seems to be, to arouse the classes and the masses to a sense of our national insecurity; but warned by the failures of those who have made and are making similar efforts, he considers, like them, that nothing short of a disaster will effect this. Mr. Norman's book is admirably written. The first chapter traces the rise of the French Navy, gives us information as to the actual position occupied by the Corsair, not the pirate, an entirely different order of being according to the author, as a factor in the wars of past centuries. How important a factor is shown by the fact that in the year 1689, 4,200 English and Dutch craft were captured by French Corsairs. Then follow biographies, stirringly written, of the greatest Corsairs, Jean Bart of Dunkirk, 1650-1702, whose name is still on many a fine *chasse-marée* and lugger along the northern coast of France, Jacques Cassard of Nantes, 1672-1740, Duguay Trouen of St. Malo, 1673-1736, François Thurot of Boulogne, 1727-1760, Levillé of Dunkirk, end of the last century, and Robert Surcouf of St. Malo, 1773-1777. In the final chapter of this well-written work Mr. Norman sounds the alarm again. Would it might fall on other than deaf ears.—L. A. H.

Submarine Boats. By G. W. HØVGAARD, Lieutenant in the Danish Navy. London: Spon, 1887. Pp. 98. Size $7\frac{1}{2}'' \times 5'' \times \frac{3}{4}''$. Weight under 12 ozs. Price 5s.

This little book deals with the strategical value of submarine boats, their history and development, and their construction, and in dealing with the last-named branch of the subject Lieutenant Høvgard gives a design of his own.

On the Growth of the Recruit and Young Soldier. By Sir W. AITKIN. London: Macmillan, 1887. Pp. 249. Size $6\frac{1}{2}'' \times 5'' \times 1\frac{1}{2}''$. Weight under 1 lb. 6 ozs. Price 8s. 6d.

This is the second edition of a book published twenty-five years ago, when the author was lecturing at the Army Medical School. The original work has been re-cast and re-written, so that the question of the selection of growing lads may be considered with due regard to the increased information on the subject, and the increased importance of the topics discussed in the lectures.

The Elements of Minor Tactics for the Use of Volunteers. By Captain C. J. BLOMFIELD, Adj. 1st V. B. Lanc. Fusiliers. Chatham: Gale and Polden. Pp. 74. Size $7\frac{1}{4}'' \times 5'' \times \frac{1}{4}''$. Price 1s. 6d. or 15s. per dozen, post free or carriage paid.

If in the multitudes of counsellors there is wisdom, in a multiplicity of tactical writers there is confusion. Captain Blomfield has wisely avoided discussing tactical problems, and has contented himself with simply telling the volunteers how, in the opinion of those who have studied these subjects, tactics can best be carried out. There are, however, many tactical operations in which in the event of an invasion the volunteers might have to take part, such as defence and attack of woods, villages, defiles, and localities, of which no mention is made in this little work. We suggest to Captain Blomfield that in the next edition these obvious omissions should be made good.—L. A. H.

Too late for Gordon and Khartoum. By A. MACDONALD, F.R.G.S. London: John Murray, 1887. Pp. 359. Size $8\frac{1}{4}'' \times 5\frac{1}{2}'' \times 1\frac{1}{4}''$. Weight under $1\frac{1}{2}$ lbs. Price 12s.

Mr. Macdonald was one of the war correspondents with the Nile Expedition, and his chief object in publishing this volume is to give his readers a more complete account of that expedition than either himself or the Press colleagues who accompanied him were at the time able to supply. In the second paragraph of his preface, Mr. Macdonald practically admits the necessary incompleteness of either the telegraphed or the subsequent despatches of newspaper correspondents from the seat of war. This honest acknowledgment, if generally known, should go far to mitigate the evils which arise from the hasty judgments formed by newspaper readers, on such accounts furnished in the daily and weekly press. We regret that we are unable to obtain for our readers any reliable judgment as to the soundness of the views and opinions and statements of facts put forward by Mr. Macdonald. The Nile Expedition is too recent for any calm and dispassionate review of the causes of its failure. This must be left for the future; and for the reviewer who essays the task, the accounts given by eye-witnesses who occupied a position such as that held by Mr. Macdonald during the operations will be of the greatest value. Whether the reviewer will endorse the criticisms and judgments on individuals authoritatively pronounced by Mr. Macdonald, we cannot say. By all who are interested in our great failure—and who is not?—the book will be found of great interest.—L. A. H.

The Fall of the Moghul Empire of Hindustan. A new edition. By H. G. KEENE, C.I.E. London: Allan and Co., 1887. Pp. 291. Size $7\frac{1}{4}'' \times 5\frac{1}{4}'' \times 1\frac{1}{4}''$. Weight under $1\frac{1}{2}$ lbs. Price 7s. 6d.

Two editions of this book being exhausted, Mr. Keene has brought out a new edition in a form more adapted to the use of students, and opportunity has been taken to introduce considerable additions and emendations. It is an excellent little work.

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